DECEMBER 1957

TOOLING & PRODUCTION

Numerical Control Is for You

. . . page 89

IN THIS ISSUE

Talk of the Month—Management's Challenge to Production & Inventory Control . . . . . Hugh D. Luke 58

Editorial—The Crystal Comes Full Circle . . . . . E. W. Pennington 71

New Progressive Die Cut and Carry Technique Saves Stock . . . . John Chismar 73

Algebraic Model Helps Decide Machine Tool Replacements . . . . . E. C. Varnum 77

Ingenious Lathe Tools for Dimpling and Countersinking . . . . . W. M. Halliday 84

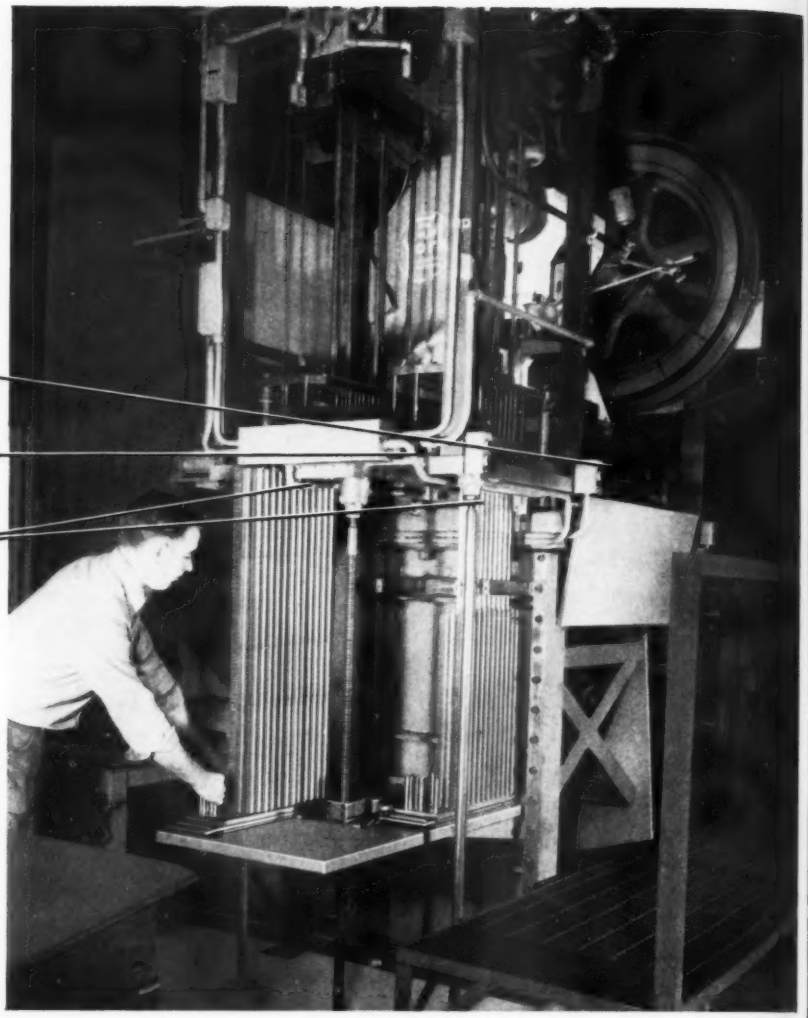
Scientific Management and Production and Inventory Control . . . . . C. E. Reuss 88

Special Report—The Dollars and Sense of Numerical Control . . . . G. MacF. Tuttle 89

Automatic-Torque Pneumatic Tools Help Caterpillar 102

DEPARTMENTS

At Your Service 12
Commendable Comments 18
Coming Events 52
Manufacturing Memos 110
Book Reviews 119
Shop Aids 139
Helpful Literature 142
Products on Parade 164
Cumulative Editorial Index 198



Tooled presses save assembly time at York

Aluminum fins (.006" or .008" gauge) are fabricated and stacked at rates up to 180 per minute.

York Division of Borg-Warner, wanted to combine a fabricating and assembly operation in the production of fin coils for air conditioning and refrigeration systems. *Objective: eliminate a time-consuming manual stacking operation that, in a period of expanding production, would grow increasingly expensive.*

V & O supplied equipped presses for the job. Fins, complete with skip-corrugation, holes and spacers, are made in a two-station die; then collected in a stacking mechanism and pushed down onto tubes.

Presses that integrate or combine operations are the primary business of V&O. Our long-slide presses are designed for automation. Our engineering is geared for it. We would welcome a chance to go over the possibilities of using mechanized presses to integrate or combine operations in your plant. Please write or call us.

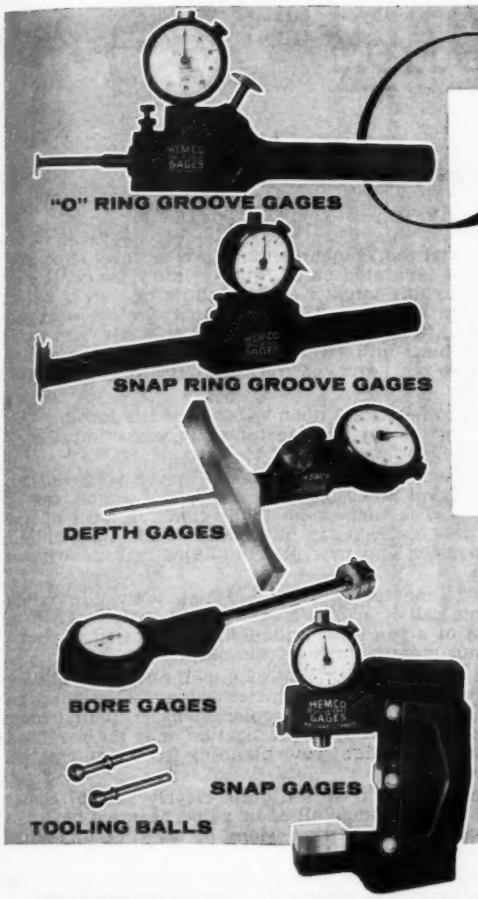
THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

421 UNION TURNPIKE, HUDSON, NEW YORK

Presses and methods that automatically reduce costs

CIRCLE INFORM-A-GRAM KEY NO. 2



Presenting

HEMCO

Reli-A-Chek

DIAL INDICATORS

Try Them — Let Them Write Their Own Performance Ticket For You

Starting June 1 The H. E. Morse Co. will offer industry precision dial indicators. These will be marketed east of the Great Divide as HEMCO — Reli-A-Chek.

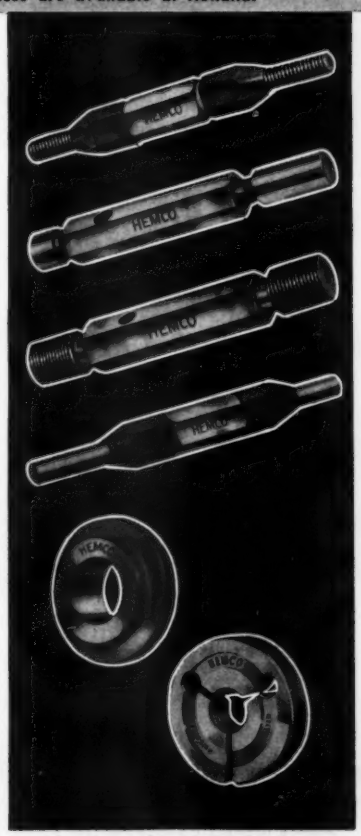
SIMPLE IN DESIGN • HIGHLY ACCURATE
RUGGEDLY BUILT • TROUBLE FREE
DEPENDABLE • HIGHLY VERSATILE
DO A WIDE RANGE OF WORK

Standard models of the various designs will be stocked by all H. E. Morse Co. distributors. Special designs can be made on order. Parts and services are available at Holland.

HEMCO PROCESS GAGES

200% to 400% more life wear than steel gages
Approximately same cost as plain steel gages
Gaging costs cut 60% or more
No lapping or grinding after HEMCO Process is applied
HEMCO Chrome-hardness is 69 to 72 Rockwell C
Unconditionally guaranteed not to chip or peel

Try Them . . .
Let Them Write Their Own Performance Ticket For You



If you have unusual gaging problems, ask us to help on design and quotations.

DISTRIBUTORS: Some fine territories are open. Why not write for information?

THE H. E. MORSE CO.

457 DOUGLAS ROAD HOLLAND, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 3

Special Size Reamers ARE STANDARD WITH L&I

TWO MORE L&I EXCLUSIVES ...AT NO EXTRA COST!

DOWEL PIN REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .1230 thru .4995" Sets, tool

OVER & UNDER SIZE CHUCKING REAMERS

Straight Shank, Right Hand Cut with Straight, Right or Left Hand Spiral Flutes.

14 Sizes from .124 thru .501" Sets, tool

These reamers are two more reasons why L&I is the source for a **complete** reamer line.

See your L&I Distributor.

L&I

"the reamer specialists"

LAVALLEE & IDE, INC.

CHICOPEE, MASS.

CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING & PRODUCTION Magazine

DECEMBER, 1957

VOL. XXIII—No. 9

GEORGE J. HUEBNER, Founder

PERSONALLY SPEAKING

Dear T&P Reader:

What with Sputnik, Muttnik and the Thingniks that have recently appeared in various corn fields in widely separated parts of our country, many of you have undoubtedly been a little side-tracked in your thinking. In spite of the almost frightening implications of dogs in the skies, the beep-beeped messages of the Russian satellite and the accepted fact that Mr. Khruschchev's boys hurled a half-ton mass into an orbit — despite these things life in these United States must go on. And that means your work, plans and thinking (and ours, too).

This interesting diversion of conjecturing upon space travel is fun, but the work of the machines and tools of our manufacturing processes must constantly move forward. And this brings me back to earth.

There is ever increasing evidence that, for the months immediately ahead, the refinements in manufacturing processes will occupy the major part of your thinking and planning. The facts seem to be that for most of our major metal working industries our capacity has finally caught up with our demand in major plant expansion and new plant building. There will, of course, be exceptions to this.

But it becomes quite clear to me that during this high plateau levelling period of our economy (some call it a mild recession although I prefer to think of it as an adjustment of a run-away inflation) your major emphasis will be on refinements of your manufacturing processes.

This may take many forms. The establishment of a well organized quality control department, the development of automatic gaging techniques, an operation research approach to machine tool replacement, including some deep thinking about machine capability and amortization, may all be refined in your planning for the future. So might your planning for the automation of your plants.

These facts and assumptions we think we see quite clearly as 1957 comes to an end. The year ahead will challenge all of us as perhaps we have not been challenged for a long time. The dimensions of our thinking must broaden.

In our "shop" the editors and the entire staff of T&P are dedicated to the task of pushing forward the frontiers of technical and practical metal working ideas. During 1958 we will give you many valuable new thoughts, and we know that some of you will make money out of them.

Good fortune to you and every best wish for a wonderful holiday season.

Cordially yours,

Ray Huebner

Publisher

TOOLING & PRODUCTION

READERSHIP in depth RESEARCH

BPA

Editorial Staff:

E. Willard Pennington, Editor
Watson N. Nordquist, Managing Editor
Carl F. Benner, Associate Editor
William E. Hoffman, Associate Editor
Carol E. Reuss, Associate Editor
G. MacF. Tuttle, Assistant Editor
Jeannette C. Traendly, Assistant Editor
Ernest J. Urbas, Contributing Editor
Nyles V. Reinfeld, Contributing Editor

Business Staff:

R. L. Huebner, Publisher
C. A. Hurt, Assistant Publisher
P. E. Hager, Production Manager
E. J. Brooks, Art Director
B. C. Jackson, Research Manager
E. N. DeCaprio, Contract Manager

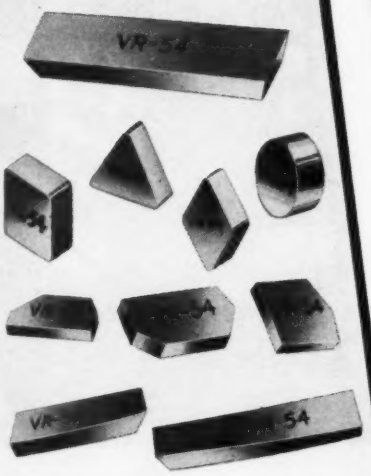
Editorial and Business Offices: 1975 Lee Road, Cleveland 18, Ohio, FAirmount 1-4040
Printing Office: 112 E. Chestnut Street, Louisville 2, Ky. (For Plate Shipments Only)

Published Monthly by HUEBNER PUBLICATIONS, INC.
R. R. HUEBNER.....Chairman, Secretary, Treasurer
RAY L. HUEBNER.....President GEORGE J. HUEBNER, JR.....Vice President

Copyright by Huebner Publications, Inc., 1957. Accepted as Controlled Circulation Publication at Louisville, Ky. Single copies $1.00 each. U. S. subscription rate $2.00 per year for metalworking plant operating executives and department heads. All other U. S. subscriptions $8.50 per year. All foreign subscriptions, $10.00 per year.

NEW CARBIDE GRADE for MILLING

VR-54



Hardness: 92.0 Rockwell "A"

Transverse Rupture Strength: 325,000 psi.

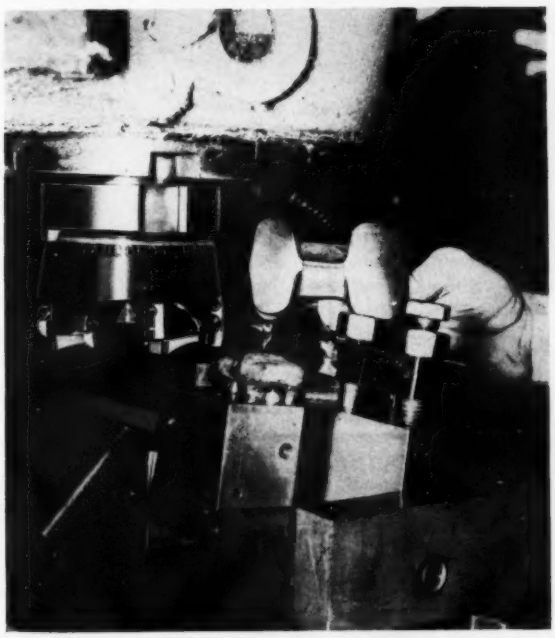
Density 14.50 g. per cc.

NEW VR-54 . . . Outstanding for interrupted cutting of cast iron, chilled cast iron, non-ferrous alloys and non-metallics

This new carbide grade incorporates toughness with high hardness to give the greatest possible resistance to abrasion and shock. These qualities enable VR-54 to outperform other cemented carbides in the removal of metal when milling, broaching, hobbing and rotary burring.

The exceptional uniformity and high quality of this new VR-54 is the result of Vascoloy-Ramet's new and unique process of manufacturing. Typical operations on which VR-54 has proved its superiority are: broaching motor blocks, milling cylinder heads, planing of planer beds, burring stainless steel rings for jet engines, milling ends of motor blocks, burring steel fabricated diesel motor blocks, and in rotary burrs for burring of all types of materials.

For complete information, call your local V-R representative or distributor or write.



MANUFACTURERS OF: CEMENTED CARBIDES, TOOLHOLDERS, TANTUNG® CAST ALLOY CUTTING TOOLS and THROW AWAY FACE MILLING CUTTERS.

Vascoloy-Ramet Corporation

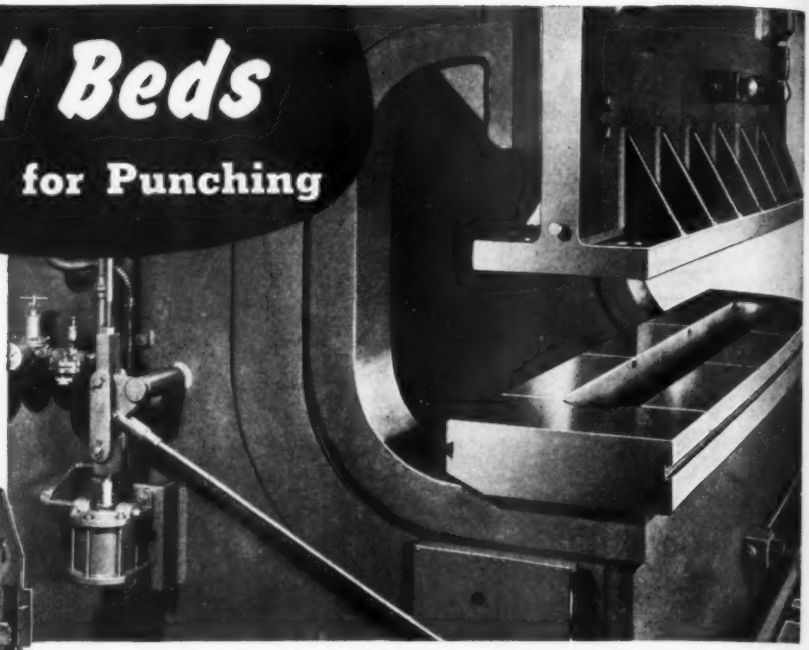
SUBSIDIARY OF FANSTEEL METALLURGICAL CORPORATION

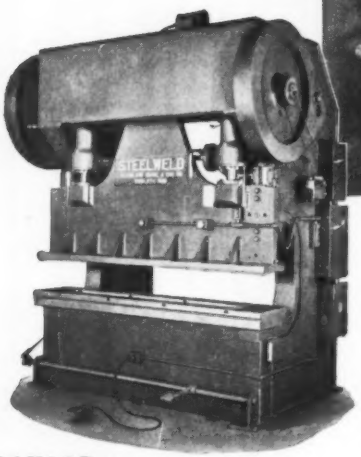
846 Market Street • Waukegan, Illinois

C-649

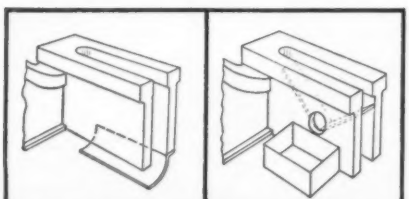
CIRCLE INFORM-A-GRAM KEY NO. 5

Slotted Beds for Punching





Model H4-6 Press with slotted bed. Handles plate to 6' 0" long between end housings. Operated by foot treadle or air-electric control.



OPEN SLOT
Long punchings are easily removed from pit in floor

VEE SLOT
Small punchings are removed from hole in bed plate

Converts Bending Press to Punch Press... and Cuts Costs as Much as 1/2

Because Steelweld Presses adapted for punching often cost as little as one-half that of ordinary punch presses a number of companies have purchased them and effected real savings.

Double-plate beds are usually employed with extra wide bed and ram to support the dies. In other respects the presses are standard. Machines have been built with beds as wide as 36", with slots in bed varying from 3" to 6¾" wide. The punchings drop between the bed plates (See sketches) and are easily removed from behind the machine.

The same presses used for punching can be used for bending and other forming operations. Steelweld Presses are standardized in all lengths to 20'-0" and in various capacities to 750 tons. Larger sizes and capacities on request.

GET THIS BOOK!

CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.
8712 East 281 Street, Wickliffe, Ohio

STEELWELD
BENDING PRESSES
BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING

CIRCLE INFORM-A-GRAM KEY NO. 6

We're not saying a word about

BENCO CARBIDE PUSHER PADS

. . . BUT HERE'S WHAT OUR CUSTOMERS SAY—

"We have completed a 260,000 piece order with two feeds per piece and the pads still look brand new. We consider these pads a worthwhile investment and a great time saver."

"Pads have been used twenty hours per day for two months and we find no wear."

"In the use of your Carbide Pusher Pads we solved feed-out variation and eliminated scratches on smooth brass stock."

"Over 7,000,000 pieces run to date on the same set of pads and the same master feed finger. The tension is still holding up and we have yet to gall."

"We have solved the problem of scratching centerless ground steel shaft with your pads."

"Your solid carbide pad is the best we have used . . . best, meaning length of service and economical price."

"The pads are still in good order running 150,000 parts and no wear detected, also the tension on the master fingers is still in good working order."

"We are quite happy with the quality of parts not having the tell-tale pusher mark."

When screw machine operators unreservedly *praise* a product, you can be certain it has proved itself to be extraordinary.

You can have the same time and cost savings advantages enjoyed by these users of Benco Solid Carbide Pusher Pads and Model "A" Master Pushers.

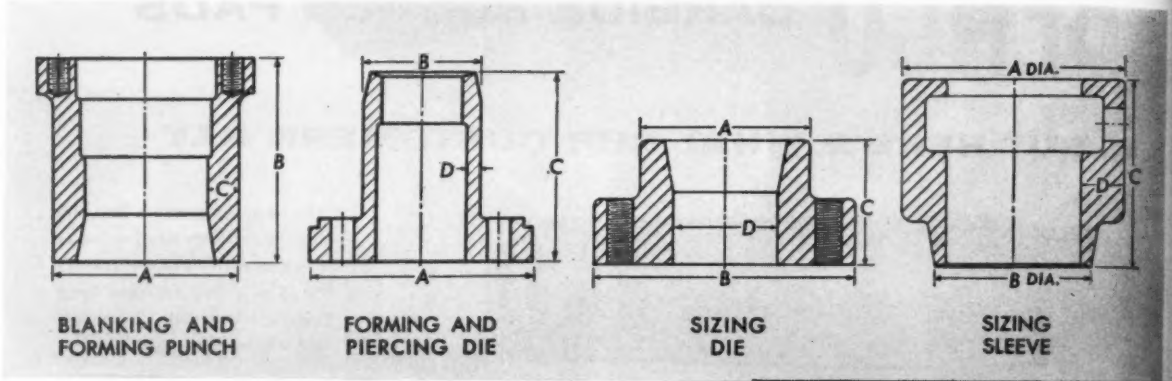
Write today for literature and prices!

BENCO collet manufacturing co.

CLEVELAND 14, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 7

Do you make ring-shaped tool steel parts like these?



BLANKING AND FORMING PUNCH | FORMING AND PIERCING DIE | SIZING DIE | SIZING SLEEVE

Graph-Mo Hollow-Bar® can cut your costs because the hole's already there

Eliminates drilling, machines faster

YOU start with finish boring when you use Graph-Mo Hollow-Bar®. The hole's already there! Because drilling is eliminated, you cut costs and speed production. And you get a tool steel that machines faster, wears longer, gives more stability.

Graph-Mo machines faster than ordinary tool steels because of the free graphite in its structure. And there's far less tendency to pick up, scuff or gall.

Reports from users show that Graph-Mo outwears other tool steels three to one on the average. That's because of the combination of free graphite and diamond-hard carbides in Graph-Mo's structure.

And you won't find a more stable tool steel than Graph-Mo. Proof: after 12 years of use, a master plug gauge machined from Graph-Mo showed less than 10 millionths of an inch dimensional change.

Specify new Graph-Mo Hollow-Bar for all your ring-shaped tool steel parts. You'll save time and money, have a better finished product. It's available in O.D. from 3 to 16 inches with many wall thicknesses.

For more information write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".

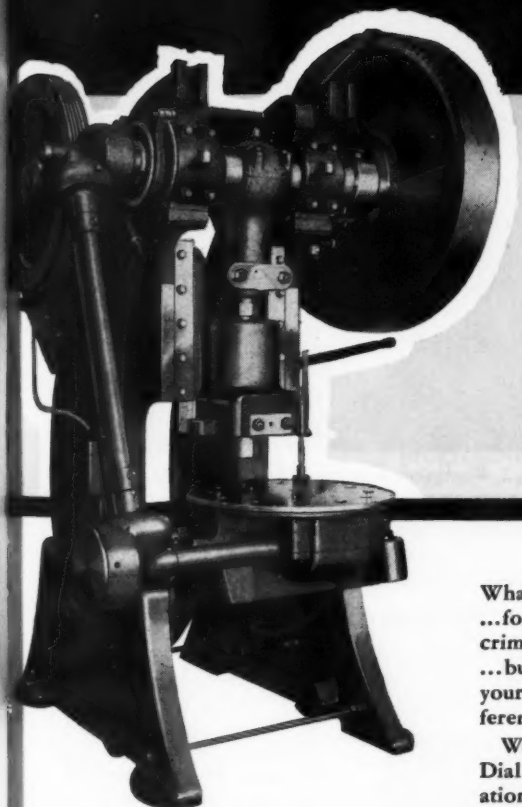
TIMKEN *Fine Alloy* STEEL

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

CIRCLE INFORM-A-GRAM KEY NO. 8

MODERN FEDERAL DIAL FEEDS have what it takes!



No. 7 Dial Feed
Capacity, 80 tons

VERSATILITY
plus
AUTOMATION

What's the job? Drawing... staking ...forming... piercing... stamping... crimping... punching... broaching ...burring... assembling? Maybe in your plant it's all of them, or a different, unique operation.

We'll lay two-to-one that Federal Dial Feeds are just what your operation needs. For the possibilities of this press with special jigging are practically unlimited. Add automatic feed and ejection and you have the answer to many cost problems.

Modernize now with Federals and eliminate the need for expensive, specialized equipment. Rugged, precision-built Federals embody the finest materials and workmanship. Available in sizes from 6 to 80 tons. *Write for new Dial Feed Catalog.*

THE FEDERAL PRESS COMPANY
707 Division Street, Elkhart, Indiana

FEDERAL DIAL FEED PRESSES

MOORE SPECIAL TOOL COMPANY

Holes, Contours, Surfaces

Published in the interests of greater accuracy and quality in the tool room and on the production line by the Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport7, Conn., builders of Jig Borers, Jig Grinders, Panto-Crush Wheel Dressers, Precision Rotary Tables, Motorized Centers and a complete line of Hole Location Accessories.

7 Tricks of the Trade in Jig Grinding Small Holes

The following tricks of the trade will prove helpful in jig grinding small holes with a diamond-charged mandrel:

1. Uniformly graded diamond powder should be used for charging mandrels. Holes from minimum (1/64″) to about 3/32″ in diameter should be roughed and finished with 80-100 grit powder. Larger holes may be roughed somewhat more rapidly with a coarser grade, 60-80 grit.

2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.

3. Since a freshly charged mandrel will cut much more rapidly than a worn one, avoid introducing a freshly charged tool as a hole nears size, Fig. 1.

4. Do not permit the uncharged *shank* of a mandrel to contact the surface being ground. Frictional heat will burn both the work and the mandrel. The former, partially annealed at point of such contact, will charge with diamond sut and probably be ruined.

5. It is generally more economical and efficient to consider mandrels as expendable and make a new one for each job. Since the cost is only a few cents, use of an old one, or even the time spent trying to match one to requirements, is hardly justified.

6. Because mandrels cannot be trued with a diamond, it is necessary to measure both the top and bottom of a hole while grinding, in order to avoid a ridge.

7. In view of point 6, it is advisable to set the work up on parallels of sufficient height to enable measurement from beneath the workpiece, Fig. 2.

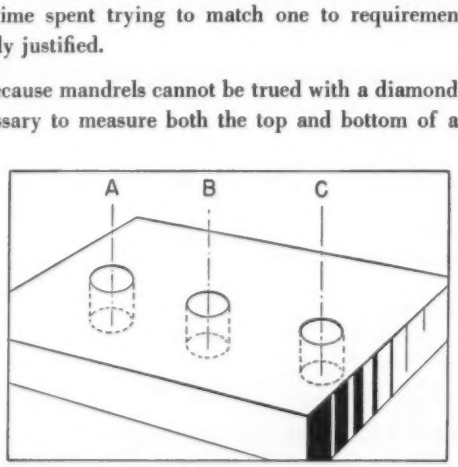


Fig. 1. In grinding three holes to size, A and B are roughed to within .001″—.002″, and C within about .005″. Using a freshly charged mandrel, C is finished to size, thereby breaking down the high points on the tool. A and B may now be safely ground to size.

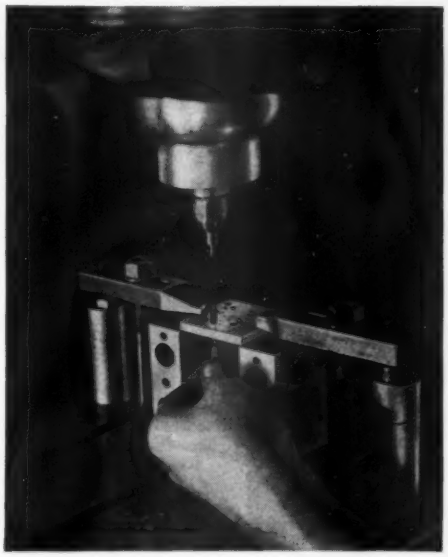
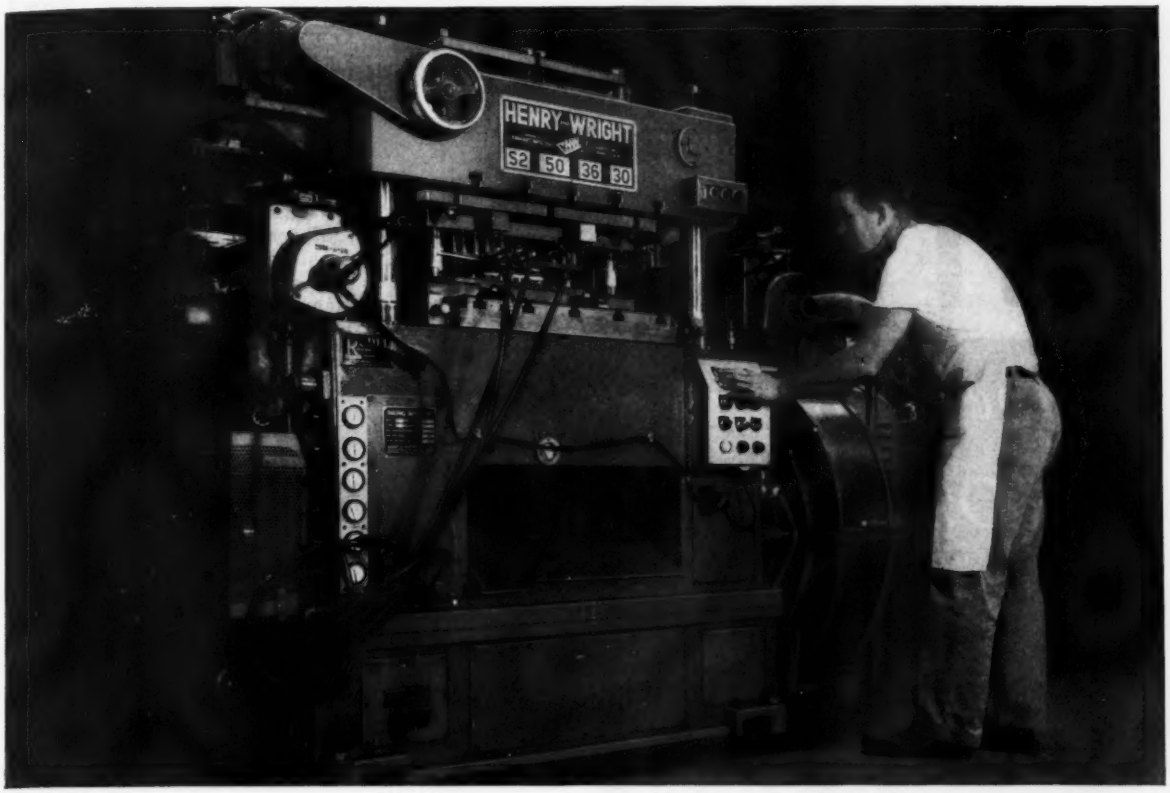


Fig. 2. Workpiece is mounted high enough to permit measuring bottom as well as top of hole.

Get ALL the answers from this new, 424-page book

The information on this page is just a sample of the valuable, on-the-job aid you can get from Moore's *all-new* book, HOLES, CONTOURS AND SURFACES. Tells you how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. 184 pages of Woodworth Coordinate Location Tables from 3 to 100 holes. Price only $5 in U.S.A., $6 elsewhere. Send check or money order to Moore Special Tool Co., Inc., 726 Union Ave., Bridgeport 7, Conn.

Another Outstanding Henry and Wright Installation . . .



Henry & Wright 50-ton Double Crank at Electric Typewriter Division, International Business Machines Corporation, Kingston, N. Y.

IBM took these steps to assure quality stamping methods

Assure quality and reduce problems inherent in separate operations by using progressive dies for key components . . . design dies so as to accommodate sub-dies for variations in a part's configuration . . . build each die to the highest standards of precision . . . use presses of exceptional accuracy to assure maximum die life.

Double Crank Henry & Wrights were selected for this program. The pay-off: 180,000 type bars produced between die grinds as against half that number with old dies on conventional press; 8,000 trip levers per hour on a Henry & Wright against 5,000 per hour by the previous method.

Operational benefits cited by IBM personnel included: after a year's use, Henry & Wrights retained parallelism-alignment within .0005"; front and back accessibility of machines reduces die set-up time; misfeeding of stock eliminated; feed length variation is negligible, thereby making adjustments unnecessary to compensate for changes in press speed; punch clamping is easier.

To be sure of the maximum pay-off for improved methods in your plant, investigate Henry & Wrights. Catalogs are yours for the asking.

Now, more than ever before, there's an H-P-M for your particular job. Write today for complete information. Make H-P-M your standard for metalworking press equipment.

HPM

HB02

THE HYDRAULIC PRESS MFG. COMPANY

A DIVISION OF KOEHRING COMPANY • MOUNT GILEAD, OHIO, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 11

AMES

...the preferred Dial Indicators...

have forged cases, backs and wheel supports for maximum stability

Accurate measurements depend on the complete absence of interfering factors. That's why Ames Dial Indicators have forged cases, backs and wheel supports for maximum dimensional stability. The extreme care put into the design and material selection of component parts typifies the Ames approach to manufacturing a superlative product. It's just one of the reasons why the lifetime cost of Ames Dial Indicators is lower, and why so many quality control engineers specify Ames as "preferred". Write today for complete information.

Representatives in principal cities

B.C. AMES CO.

23 Ames Street, Waltham 54, Mass.

MANUFACTURERS OF MICROMETER DIAL GAUGES • MICROMETER DIAL INDICATORS

CIRCLE INFORM-A-GRAM KEY NO. 12

At Your SERVICE

With the addition of a new king size Leonard Bendmaster, Model 76, Tube Specialists of Santa Ana, Calif. now offer a precision, high production bending and fabricating service on all types of tubing up to 6" OD. The company also offers a complete engineering service for new product design and development. With expanded facilities the company services the 11 western states.

•

Research and development work is being carried on by Western Sealant Co. of Culver City, Calif. which applies the vacuum impregnation process to materials and components of all types. This experimental engineering and consultation service is available and the company will give evaluations and comparisons of numerous impregnants on request, to formulate special duty materials with specialized impregnating characteristics for particular applications.

•

Apex Broach Co., Inc. of Detroit, designers and producers of broaches, holders, and fixtures, has announced facilities and services they provide to customers. They advise about machines and production requirements for every broaching problem.

•

Plume & Atwood Mfg. Co. of Thomaston, Conn. offers their manufacturing service to companies who wish to use Plume & Atwood's engineering, production, finishing, assembly and packaging facilities for production.

•

Many special parts are mass produced to exact specifications by Merit Specialties Co., Inc., St. Louis. Cross-drilling, double cross-drilling, cross-tapping, etc. can be accomplished on a single machine.

•

Several services are offered by Ernest, Holdemand & Collet, Inc., Indianapolis. They include special design, construction, and rebuilding of machinery.

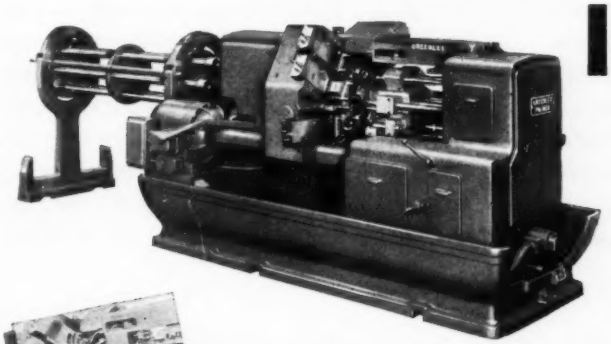
•

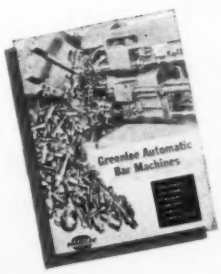
Get an extra life from carbide and ceramic inserts by using the lapping service for these tools offered by Carbilap Co., St. Paul, Minn. Lapping cost on a typical triangle throwaway is only $.25, as compared with the initial cost (ground) of $1.10 for an identical blank.

1. Simplified cross-slide camming
2. Interchangeable cross-slide tool holders
3. Quick-adjusting stroke mechanism
4. Rapid speed and feed changes
5. Wide-open, easily reached tooling area
6. Built-in threading feed and drive
7. Easily accessible main toolslide holders
8. Stationary type collets changed quickly

eight big reasons why you get *Fast Setups* on GREENLEE BAR AUTOMATICS

In plant after plant countless hours of setup time are saved each year on Greenlee Bar Automatics. Similar savings in time and money can be achieved in your own plant. Greenlee has on-the-job case studies to prove it. Whether your responsibility lies in the field of management . . . production . . engineering . . . or purchasing you owe it to yourself and your company to call in the Greenlee man. Let him show you why and how faster setups on a Greenlee pay off in greater profits.





PRODUCTION MACHINERY
GREENLEE

4-SPINDLE...6-SPINDLE
SECOND-OPERATION
PNEUMATIC STOCK FEED

WRITE TODAY
FOR CATALOG
A-405

PRODUCTION MACHINERY
GREENLEE

GREENLEE BROS. & CO.
2052 Mason Avenue
Rockford, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 13

Here's Another Clearing TRANSFLEX idea that

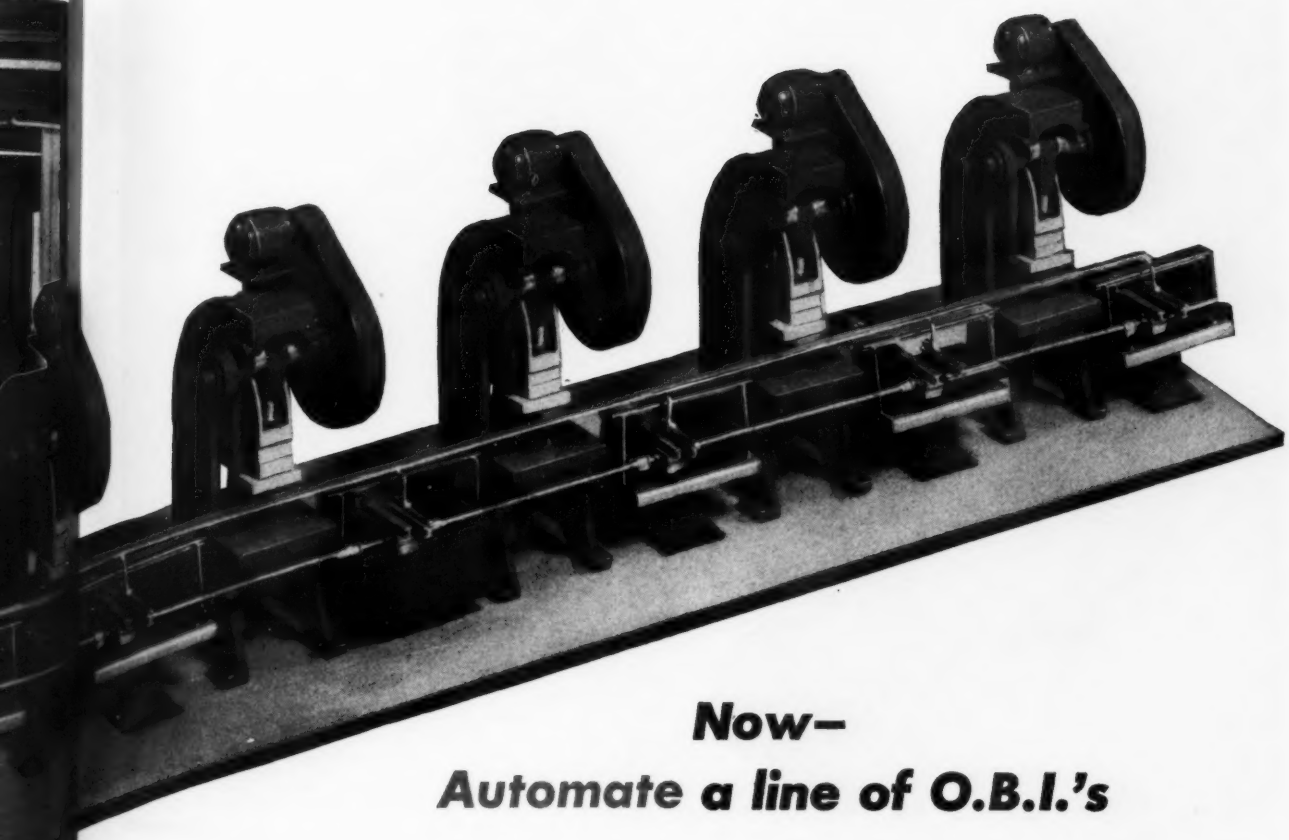
Did you ever think of the productive possibilities of turning a group of O.B.I.'s into a speedy, automatic transfer machine? That's exactly what Clearing has done in the new O.B.I. transflex setup. As few as two or as many as seven or eight O.B.I.'s can be unified into a single automated group.

What's more, Clearing's Transflex feed is completely flexible, fully adaptable to take on parts of varying size. Finish one job, and you can reorganize the line to fit the requirements of the next run. Then if the work load in your shop changes completely, you can use the machines independently of each other, or in groups of two or three as the work demands.

CLEARING

CLEARING MACHINE CORPORATION

6499 W. 65th STREET • CHICAGO 38, ILLINOIS



Now—
Automate a line of O.B.I.'s

with CLEARING O.B.I. TRANSFLEX

can bring automation to every stamping shop.

O.B.I. Transflex is a husky, carefully designed piece of equipment. In spite of its versatility, it's as rugged as any feeding equipment you can find.

This Clearing Transflex idea can be a life saver for cutting manufacturing costs of your product. Or, if you have a job shop you can really be competitive in quoting long run jobs. That's right, O.B.I. transflex is flexible enough for a job shop. And it doesn't tie up a lot of capital in single purpose equipment.

Want to get specific about this new Clearing Transflex idea? Just tear out this page and send it to Clearing. We'll send this bulletin on ***O.B.I. Transflex*** *right away.*

PRESSES the way to efficient mass production

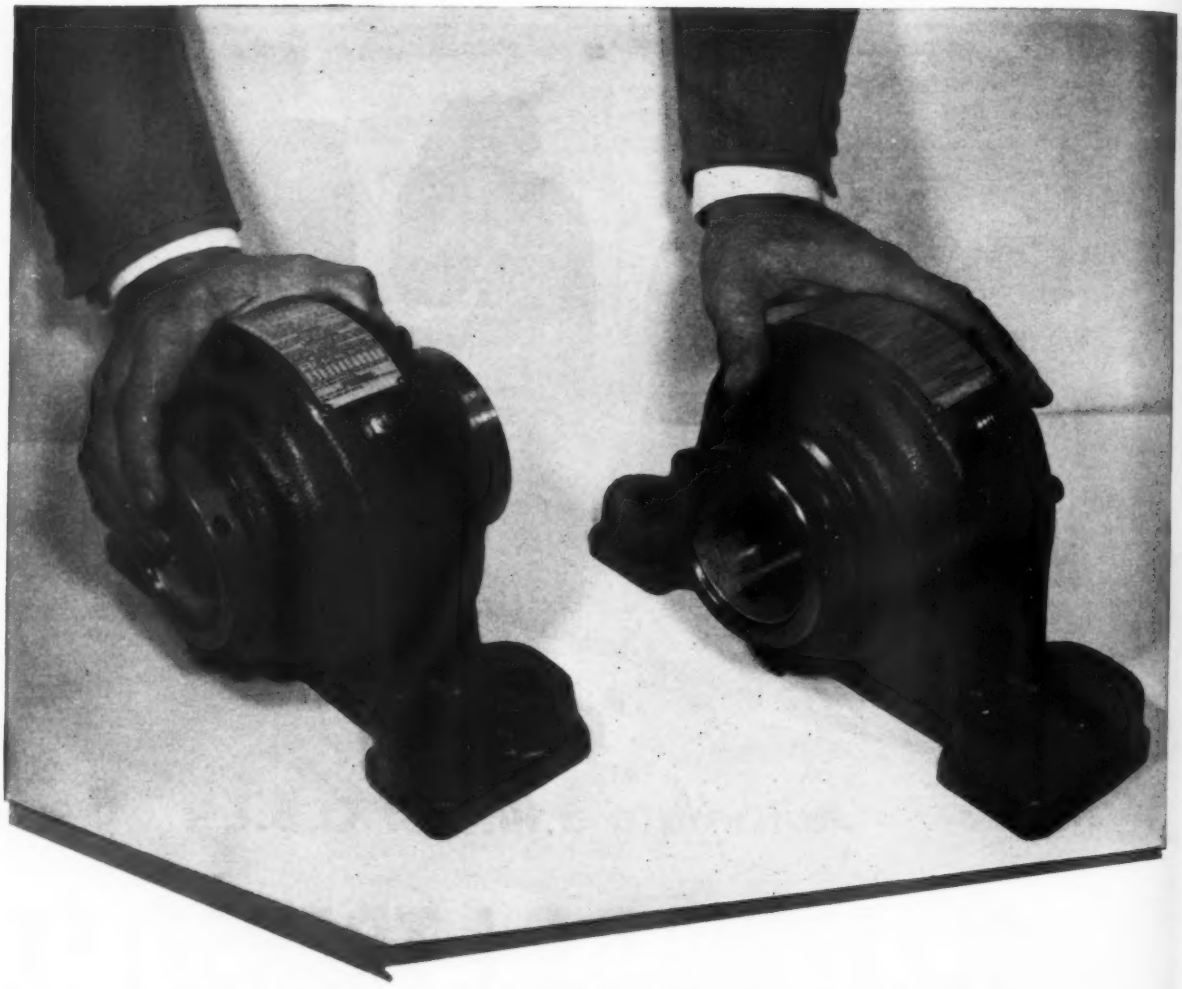
division of **U.S. INDUSTRIES, INC.**

HAMILTON DIVISION, HAMILTON, OHIO

USI

CMC CLEARING

CIRCLE INFORM-A-GRAM KEY NO. 15



There's a big difference in these pillow blocks . . . Bearings, Inc. knows the difference. Do you?

One of these pillow blocks contains a non-expansion or "fixed" bearing unit. The other is an expansion or "floating" bearing. Mix them up—order a "fixed" bearing where conditions dictate an expansion unit—and you are in trouble. Bearing failure in a very short time is almost certain.

One of our customers recently ordered spare bearings for new coal handling equipment and overlooked that important difference. They allowed us to check their survey of bearing requirements against the actual bearings installed on the equipment. We found on many applications "floating" units were required and their order failed to specify this vital point. Savings in time, trouble and money for our customer by this simple check were important.

Let us help *you* survey your bearing requirements—let us check the actual bearings in your equipment and we will be ready with the correct bearings you need when you need them. Call or write our branch nearest you now!

Providing bearing service in the north ➤

BEARINGS, INC.

OHIO: Akron • Canton • Cincinnati • Cleveland • Columbus • Dayton • Elyria • Hamilton • Lima • Lockland • Mansfield • Toledo • Youngstown • Zanesville
INDIANA: Ft. Wayne • Indianapolis • Muncie • Terre Haute • **PENNSYLVANIA:** Erie • Johnstown • Philadelphia • Pittsburgh • York
WEST VIRGINIA: Charleston • Huntington • Parkersburg • Wheeling • **NEW JERSEY:** Camden
NEW YORK: Buffalo, Balanrol Corp. • **MARYLAND:** Baltimore • **DELAWARE:** Wilmington

and in the south ➤

DIXIE BEARINGS INCORPORATED

FLORIDA: Jacksonville • **GEORGIA:** Atlanta • **KENTUCKY:** Louisville • **LOUISIANA:** Baton Rouge • New Orleans
N. CAROLINA: Charlotte • Greensboro • **S. CAROLINA:** Greenville • **TENNESSEE:** Chattanooga • Kingsport • Knoxville • Nashville

CIRCLE INFORM-A-GRAM KEY NO. 16

Talking About Die Sets

with

Phil Marsilius

Executive Vice-President
The Producto Machine Co.

How to Select and Order a Catalog Die Set—Do you always order the die set you *really* need for the job... or do you overlook a specification which results in your having to "make do" with the set you ordered or lose time by having to re-order?

Once again, we feel that a simple and basic practice should be emphasized because our daily experiences show that even the most painstaking individual occasionally overlooks one or more factors in preparing to place an order.

Here is our suggested check-list for selecting and ordering a catalog die set:

1. Lay out the die. Allow sufficient area for feeding devices and auxiliary stock guides that may be required. Determine also what areas must be left clear for part ejection or scrap.

2. Determine type of set you need—rear two-pin, four-pin, center-pin, etc.—according to tolerances and construction of die.

3. Place layout on templates for the type of die set you have chosen. Select die area that best meets the limits established in Step 1.

4. Select material for die set—semi-steel, all-steel or combination—based on the die's strength requirements.

5. Select thicknesses of punch and die holder in line with strength requirements and allowable press shut height.

6. Determine length of guide-pin required*, based on length of stroke or ram clearance.

7. Determine type and length of bushing and material from which it should be made, based on accuracy, speed of operation and required life expectancy of die.

8. Select shank diameter for the press on which die will be run.

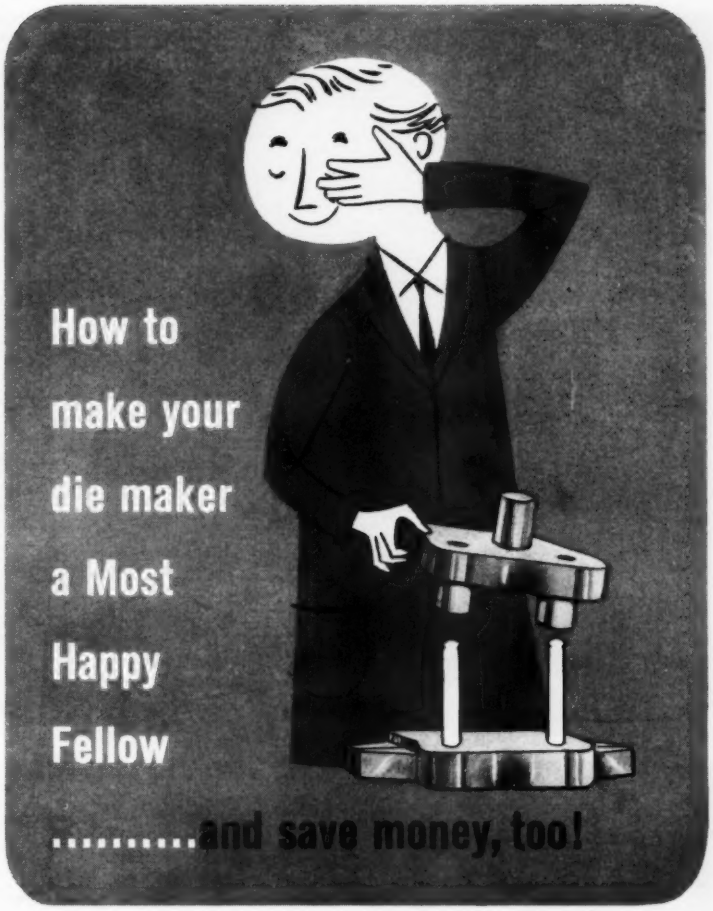
9. Choose grade of precision required—Master or Commercial—based on tolerances and number of pieces to be produced.

10. Order die set which meets most closely the above requirements, making certain that *all* ordering information is included: Catalog number and quantity; Master (Precision) or Commercial grade; length of guide pin; type of bushing; diameter of shank or "no shank"; how to ship. Keep in mind that special thicknesses of punch holder and die holder can also be ordered if required.

Of course, you may not find it possible to check these points in the exact sequence presented. However, if you will make it a habit to use this check-list for each die set you need, you can avoid making costly errors in ordering.

*"L" dimensions pertaining to pin length as shown in die set catalogs refer to distance from bottom of die holder to top of pins. They do not necessarily apply to actual guide pin lengths.

Adv.



It's easy. Just be sure to specify Producto die sets with *Qwik-Fit guide pins.*

Then your die maker will always be able to assemble and disassemble his die sets practically blindfolded! No longer will he have to line up pins and bushings cautiously... tediously hammer die sets together... or pry them apart. With Qwik-Fit guide pins, the die set almost *puts itself together.* The spherical-angular radius on these pins prevents jamming or cocking *regardless of how the punch holder is started on.*

Think of the time your die maker will save... and the money *you* will save. Dies are growing more complex daily and that means assembly and disassembly of the die set dozens of times. In plants all over the country, Producto's Qwik-Fit pins are saving up to 75% of the time formerly required for these operations.

To improve morale and increase productivity, join the growing ranks of die manufacturers and users who specify "Producto die sets with Qwik-Fit guide pins." They are available on Master die sets at no extra cost.

HOW TO MAKE ORDERING EASIER:

Get your free copy of Producto's Die Set Catalog No. 11, designed specifically to simplify your selection and ordering job. And ask to receive the idea-filled Die Set Digest, too.

THE PRODUCTO MACHINE COMPANY
970 Housatonic Avenue, Bridgeport 1, Connecticut

PRODUCTO

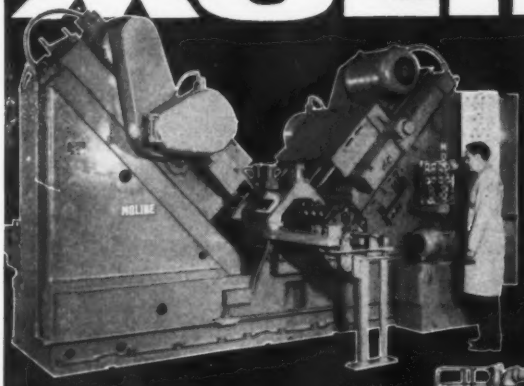
Wherever die sets are used

PRODUCTO

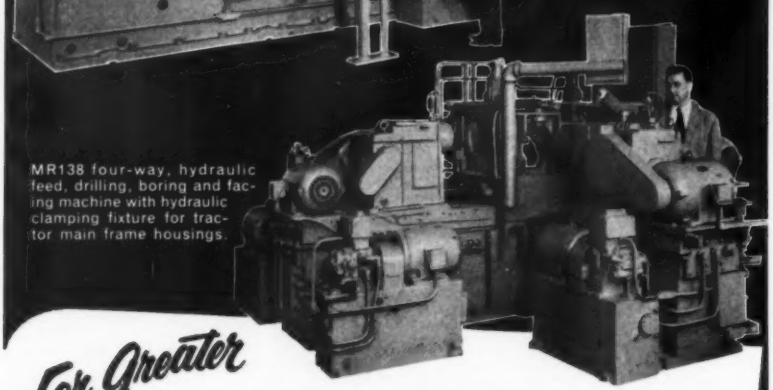
PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

CIRCLE INFORM-A-GRAM KEY NO. 17

MOLINE



No. 13CB V-type cylinder boring unit is used either as an individual machine or as one of several automated units in a transfer line for boring automotive engine cylinders.



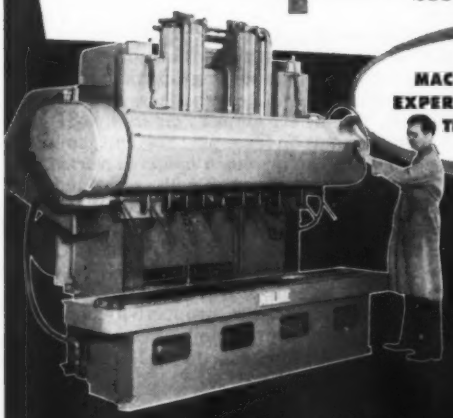
MR138 four-way, hydraulic feed, drilling, boring and facing machine with hydraulic clamping fixture for tractor main frame housings.

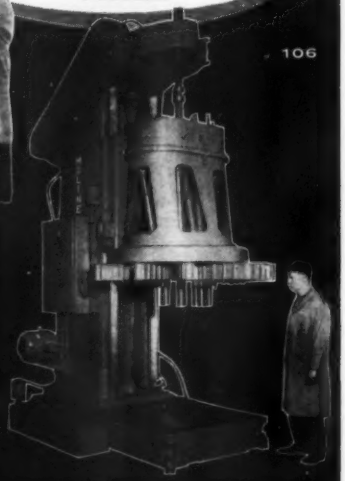
For Greater PRODUCTION . . . EFFICIENCY . . . SAVINGS

Use an individually designed "Hole-Hog" Machine Tool for such jobs as...

- Multi-Spindle Boring
- Single and Multi-Spindle Honing
- Straight Line Multi-Drilling
- Adjustable Spindle Drilling
- Vertical and Way-Type Fixed Center Drilling, Boring and Tapping
- Special Multiple Operation Machine Tools

OVER 55 YEARS OF MACHINE TOOL ENGINEERING EXPERIENCE IS AT YOUR SERVICE. TELL US YOUR PARTICULAR PROBLEM





106

HD67 hydraulic rail feed, straight-line type, multi-spindle drilling machine. Six-foot rail length as shown; also available in eight and ten-foot lengths.

No. 116-U hydraulic rail feed, universal joint type driller with 16 two-speed and neutral top drivers plus four-speed quick change gear box. Spindles illustrated are 1½" drill capacity each in mild steel.

MOLINE TOOL CO. "HOLE-HOG" MOLINE, ILLINOIS

MOLINE TOOL COMPANY

REPRESENTATIVES IN PRINCIPAL CITIES

100 20TH STREET • MOLINE, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 18

"Commendable Comments"

"Our nation is approaching a depth of conformity which could change our economic standards. In some cases it has reached the point where social norms are actually determining fundamental issues and even morality." Unless the trend is reversed, "we will be a race of thought-controlled robots."

—Melvin H. Baker, chairman of the board, National Gypsum Company, at AMA Fall Personnel Conference.

"By 1959, our estimate is that the steel industry will have raised its annual capacity from the present 113.5 million tons to more than 146 million tons."

—William Butler III, assistant to the director of market and commercial development, Lukens Steel Company, at Commerce & Industry Conference of Greater Philadelphia.

". . . I look for major changes in all engineering curricula, many of them generated by the great revolution now in its early stages in which many control functions now handled by men will be taken over by machines."

—Dr. John A. Hrones, vice president for academic affairs, Case Institute of Technology, at 12th Annual ISA Instrument Automation Conference in Cleveland.

"One of the most dramatic areas of the future will lie, I believe, in our fast increasing ability to solve mathematical, engineering, and scientific problems with the help of mechanical brains, and to build machines that will outperform anything we have today. The keys to man's ability to grapple successfully with the technological revolution which he is creating are the computor and photo-electric sensing devices. These will enable us to think faster than the machines. Giant strides are now being taken in running complex machines by magnetic taped instruction. We can now machine difficult parts to tolerances closer than any heretofore possible, and repeat the operation indefinitely by putting the instructions to the milling machines on magnetic tape. These machines surpass even our most skilled machinists in repetitive skill."

—Dr. H. J. Rand, president, Rand Development Corporation, at an AMA meeting in New York.

END MILLS ARE OUR BUSINESS . . .
NOT A SIDELINE

TO BEST SERVE YOUR NEEDS

For over twenty years our designing and manufacturing abilities have been devoted to producing highest quality end mills. Because end mills are our business, we realize that universal acceptance of our product is obtained and maintained by continuously supplying the best end mills available.

Putnam manufactures and stocks over 1400 standard types and sizes of end mills. Thus, you can quickly and economically select the exact size and type to best meet your needs.

Putnam Distributors from Coast-to-Coast carry large stocks of standard end mills. Contact your neighbor, the local Putnam Distributor, he will recommend the best end mill for specific jobs, give you personalized service, and quickly supply your needs with the finest end mills obtainable.

PTC

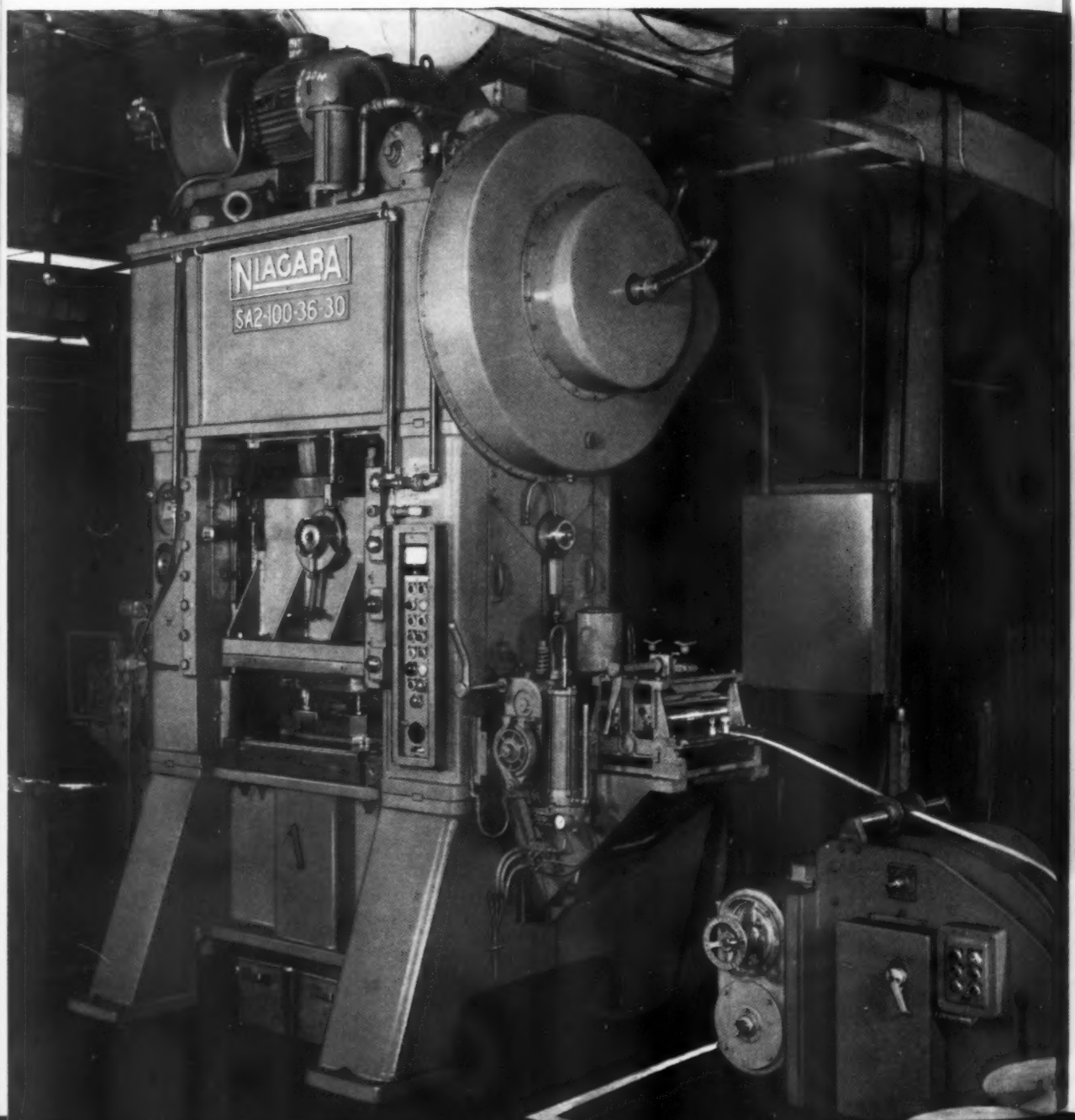
PUTNAM

TOOL COMPANY

2981 CHARLEVOIX AVENUE • DETROIT 7, MICHIGAN

5853

Ready for you... *ALL-NEW*



AUTOMATIC PRESS

to give you more stampings per hour at less cost... in long and short runs

Build your stamping profits to new heights the modern way: Automatically . . . with an all-new Niagara SA-2. Here's an up-to-the-minute press package that is distinctly different from anything heretofore available . . . complete with ultra-modern automatic feed, plus today's most advanced press mounted controls and devices, to bring you high speed stamping at its very best.

Brand new from crown to base, the Niagara Automatic boasts bonus features throughout . . . features that are unavailable on any other press in this category. Yes, *everything* is new about it, differing sharply from modified, adapted straight side presses of conventional design. Every square inch of its extra massive, rugged construction is *heavier . . . far heavier* for vibration-free, precision performance at high speeds:

KING SIZE CRANKSHAFT AND CRANKPINS — substantially larger than those on traditional straight side presses.

ENTIRE DRIVE IS HEAVIER — gears, electro pneumatic friction clutch, brake, flywheel and motor.

EXTRA BEARINGS — for better support of crankshaft, feed take-off and main gear (or flywheel).

MASSIVE, EXTRA HEAVY FRAME — all steel, 4-piece, tie rod, box type construction (bed, uprights and crown) built to absorb shock and vibration, and provide greater resistance to deflection. Up to 100% heavier than regular straight side press construction. Uprights extra wide to house electrical and circulating oil controls.

RIGID, EXTRA REINFORCED, BOX TYPE SLIDE remains in precise alignment with bed.

EXTRA LONG, SPECIAL SQUARE GIBS guide slide precisely.

LAMINATED, NON-METALLIC WAYS positively prevent welding or galling of bearing surfaces.

AUTOMATIC CIRCULATING OIL SYSTEM keeps all press bearing surfaces continuously lubricated.

ULTRA-MODERN AUTOMATIC FEED perfectly mated to press.

EXCLUSIVE NIAGARA MECHANICAL ROLL LIFTING SYSTEM — built into the press for independent, infinite adjustment of ingoing — outgoing rolls, from floor level.

OVERSIZE ADJUSTABLE AIR COUNTERBALANCE for smoother, safer press performance.

From start to finish, automatic stamping the Niagara SA-2 way, spells endless economies for you. It will pay you to investigate the facts *now*.

THE FULL STORY is unfolded for you, feature by feature, in new, illustrated Bulletin 264. Write for your copy today . . . then consult a Niagara representative.

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N. Y.

DISTRICT OFFICES: Boston • Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries

NIAGARA

SERIES SA-2, TWO-POINT STRAIGHT SIDE PRESSES

SHAFT DIAMETERS: 4½-9 INCHES • CAPACITIES: 60-300 TONS

America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work

CIRCLE INFORM-A-GRAM KEY NO. 21

NOW all SUPERIOR die sets have Superfinish

GUIDE PINS

HIGH LUSTRE MICROFINISH (2-5 Micro Inches)

Results in

1. **Maximum Surface Hardness**
2. **Increased Bearing Surface**
3. **Longer Pin and Bushing Life**
4. **Greatly Reduces Possibility of Scoring**
5. **SMOOoooother Action**

The process of Super Finishing removes the soft outer skin (appx. .0002-.0003) caused by the heat induced as a result of grinding.

Super Finish eliminates charging which is common to pins lapped with an abrasive compound.

Super Finishing, long a prerequisite in the Automotive and Aircraft Industry for precision bearing surfaces, is now a standard on Superior guide pins. With Super Finished guide pins ideal clearances can be maintained due to a greater bearing surface.

For Fast Local Service Call These Superior Representatives

Kalamazoo, Mich. Fireside 5-7988
Indianapolis, Ind. Clifford 5-5666
Rockford, Ill. 3-3931
Dayton, Ohio Hemlock 6209
Chicago, Ill. Randolph 6-8571
St. Louis, Mo. Jeff 5-1323
Dallas, Texas Riverside 5158
Winter Park, Fla. 4-0464
Minneapolis, Minn. FR 1-1321
Memphis, Tenn. 28-7727
East Orange, N. J. Orange 5-5810
Denver, Colo. Enterprise 234
Agawam, Mass. Republic 9-1132
Madison, N. J. Frontier 7-0607
Schenectady, N. Y. Franklin 2-4381
North Haven, Conn. Cedar 9-1661
Racine, Wis. Melrose 2-1999

Plants at
Milwaukee, Wis. Mitchell 5-0037
Plainville, Conn. Sherwood 7-2761

another die set advancement by **SUPERIOR** STEEL PRODUCTS CORP. 2754 S. 19th ST., MILWAUKEE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 22

Do You Waste Thread Ring Gage Life? Are You Using Full Ring Tolerance?

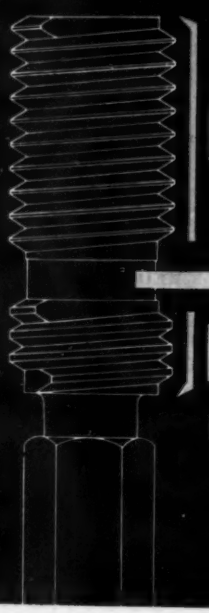
Pipe Machinery Hilo Set Plugs are

The One Sure Way to Tell

Can you be sure your thread ring gages and other adjustable instruments for inspection of male threaded parts are not being scrapped before you have used the tolerance to which you are entitled? If you're employing conventional setting plug gages that depend on the human yardstick . . . the individual operator's sense of feel and snug fit . . . you can't. Chances are you're wasting ring life!

Pipe Machinery's new more accurate Hilo Set Plugs are designed with two sections having different pitch diameters but identical lead and angles. The front end is made to the extreme low limit of prescribed ring gage pitch diameter tolerance—the back end to the high limit. There's no guesswork in sizing and setting. If the smaller end of the plug enters and the larger end is held out, the ring is the proper size for the tolerance specified. You use all the life built into your adjustable thread gages . . . reject them instantly and positively when the ring is out of limits.

Write for additional information.



PATENTED 2789360

THE
PIPE MACHINERY COMPANY
29100 Lakeland Blvd. · Wickliffe, Ohio
Greater Cleveland

CIRCLE INFORM-A-GRAM KEY NO. 23

REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS REID PRECISION SURFACE GRINDERS

REID PRECISION SURFACE GRINDERS REID PRECISION SURFAC GRINDERS RECISION SURFACE DERS RE

MODEL 618P
(large illustration)
with dust collector,
and (small illustration) with
wet grinding attachment.

A Complete Line of 618 and 824 Toolroom and Production Grinders

. . . and accessories

PRECISION REID SURFACE GRINDERS

REID-O-MATIC 824

REID . . . the quality name in surface grinders! Choose from three different models in the 618 class; capacity 6″ wide, 18″ long, 17¼″ from spindle center to table. Accessories can be supplied for wet grinding, cool grinding, dust collecting, etc.

REID-O-MATIC 824 . . . this fully automatic surface grinder has a capacity of 8″ wide, 24″ long and 21″ from spindle center to table. All-electric controlled — solid construction — available with accessories above.

Get *all* the facts on REID grinders . . . your best buy for toolroom and production economy!

Bulletins
Write for brochures on the REID 6-18 and REID-O-MATIC 8-24 for complete details

PRECISION REID SURFACE GRINDERS

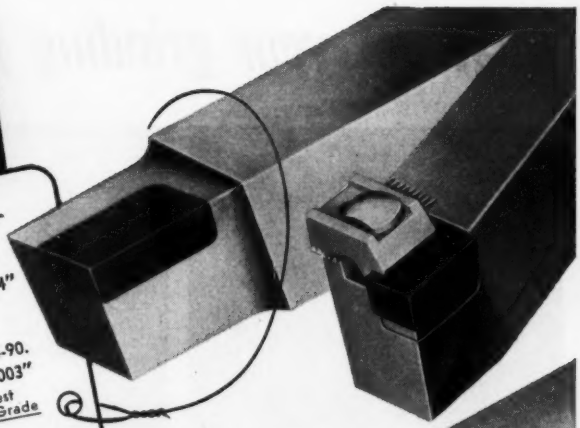
REID BROTHERS COMPANY, Inc.

136 Elliott Street, Beverly, Massachusetts

MANUFACTURERS OF PRECISION GRINDERS AND PRODUCTION LATHES

CIRCLE INFORM-A-GRAM KEY NO. 24

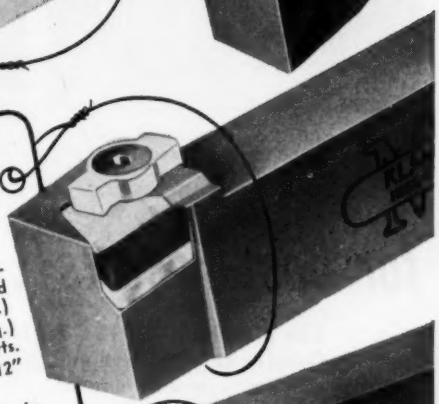
Talide® Tools... PROVED BEST BY TEST!



COSTS ONLY $1.65 Leading appliance manufacturer gets superior results with Talide standard brazed-type tool.

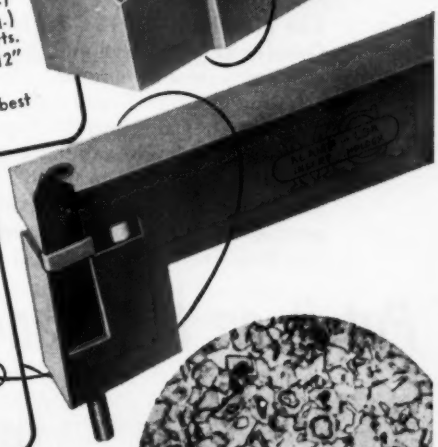
Machine.....Gisholt Turret Lathe.
Part.....Stud for automatic washing machine 3/4" dia. x 4" long, 1045 Steel, Rockwell 28 "C".
Operation.....Complete finishing including threading of end.
Tool.....Standard Talide tool AL-10-5/8" sq. x 4", Grade S-90.
Speed (S.F.M.).....400 Feed.....005" Depth of Cut.....003"

	Talide Grade S-90	Next Best Premium Grade
Average No. of pcs. per grind	600	475
Average No. of regrinds per tool	16	14



90 DAYS OF GRUELING TESTS at eastern aircraft engine plant rates Talide Grade S-92 "Best by Test."

Here is one typical result:
Machine.....36" Bullard Multimatic
Material.....AMS-5613 Stainless Steel
Operation.....Facing, turning and boring 21" O.D. x 2.5" thick casting to size. (Heavy scale, bead weld, and out of round surfaces presented adverse machining conditions.)
Tools.....TN-163P3 (1/2" I.C.) and SN-243P3 (3/4" sq.) Talide "Throw-away" triangular and square inserts.
Speed (S.F.M.).....375 to 1100 Feed.....006" to .012"
Depth of Cut...060 to .500
Result.....27-34 Pc. average compared to 7-12 for next best premium grade—plus tool breakage cut 75%.

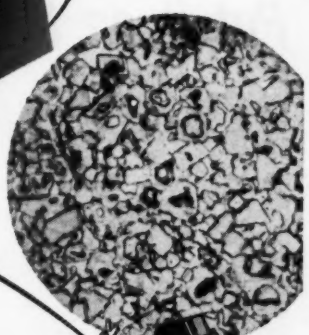


BEST CUTTING METAL FOR MACHINING CRANKSHAFTS

A large midwest automotive plant recently conducted an extensive test to determine the best cutting metal for machining crankshafts—the results proved TALIDE "BEST BY TEST!"

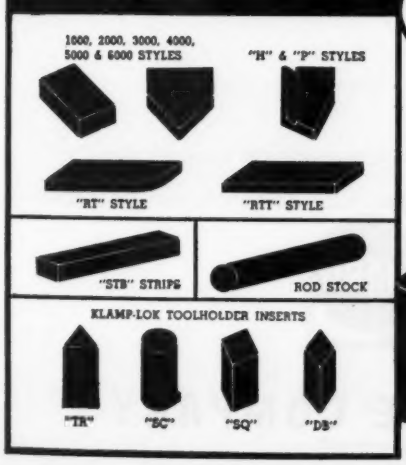
Machine.....Fay Automatic Lathe Feed.....006"
Speed.....800 R.P.M. Depth of Cut.....035"
Cutting Tool.....Style TB-12123 Triangular Insert

Material	Talide Grade S-90	2nd Best Carbide	3rd Best Carbide
1141 Steel	175 pcs.	120 pcs.	97 pcs.
4140 Steel	128 pcs.	70 pcs.	65 pcs.
Armor Steel	83 pcs.	65 pcs.	65 pcs.



CONSTANT RESEARCH PAYS OFF!

Year after year Talide metal improves in hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces under rigid laboratory control—all Talide grades are uniform and consistent in quality.



Call in a Talide sales engineer to recommend proper tooling for your machining operations, or write for 76-page catalog No. 56-G. METAL CARBIDES CORPORATION, 6001 Southern Blvd., Youngstown 12, Ohio.

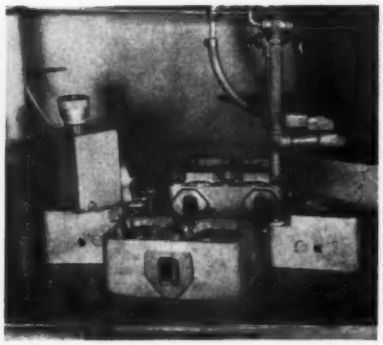
METAL CARBIDES CORPORATION
MC TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 25

Whatever your grinding job may be...

200 adjusting screw washers are ground on one side in one hour. Stock removal .025"; limits ± .001".

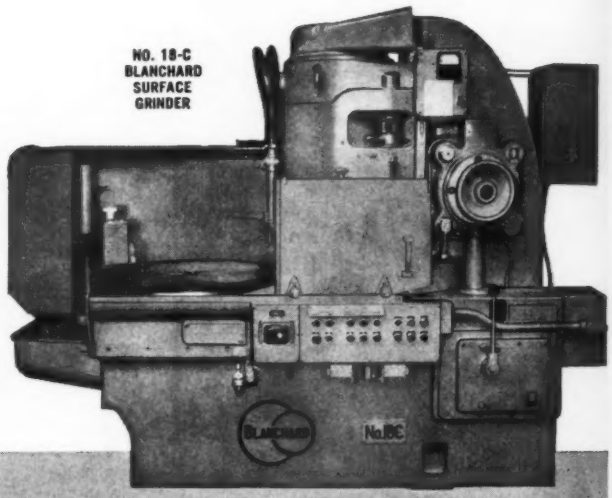


Tops of cylinder heads ground 21 per hour; stock removal 3/16" to 1/4". Bottoms 55 per hour; stock .012"; limits ± .001".

56 cast iron plates are ground on one side in one hour. Stock removal .140"; limits .001".

for best results...

The Blanchard No. 18-C Surface Grinder has the speed and precision that guarantees economical grinding on an endless variety of jobs. After the initial setup, the automatic cycle handles every operation from start to finish. The operator is freed to prepare the next load or to operate a second No. 18-C Grinder.



NO. 18-C BLANCHARD SURFACE GRINDER

Put it on the Blanchard

The 18-C Automatic Cycle...

Moves chuck to grinding position and starts it rotating

Starts wheel rotation and coolant pump

Provides rapid wheel approach to work

Engages power down-feed at preset rate

Changes to fine feed just before finished size is reached

Stops feed when work is to size — "sparks" out. Raises wheelhead

Stops wheel, coolant pump, and chuck

Moves chuck to loading position — demagnetizes chuck

Can be changed quickly to manual operation

Automatically Controls Size!

Send today for your free copy of 18-C folder.

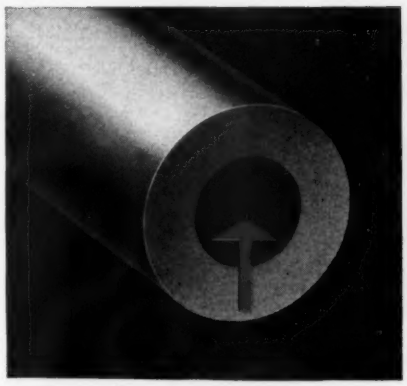
BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

CIRCLE INFORM-A-GRAM KEY NO. 26

a hole here is a hindrance...



a hole here is a help

Crucible Hollow Tool Steel sections, cut to length, save you time and money when you make ring-shaped, or tubular parts, or tools with a center hole. Because these tool steel sections are already drilled through when you get them, you don't have to bore, drill, cut-off or rough-face. Production time goes down, and most scrap losses are eliminated.

Five popular grades of Crucible tool steel are available immediately from warehouse stock, in hollow-disc form. They are KETOS oil-hardening, SANDERSON water hardening, AIRDI 150 high-carbon, high-chromium, AIRKOOL air-hardening, and NU-DIE V hot-work tool steels. Order the O.D. and I.D. combination, and length and thickness you need.

Let your Crucible representative show you how hollow tool steel sections can reduce production time, and save you money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 27

ALL THE **PRODUCTION** YOU'LL *EVER* WANT—

ALL THE **PRECISION** YOU'LL *EVER* NEED

RIGIDITY and STAMINA TOO!

Generates spur gears, spiral gears, bevel gears, face gears, worm gears, worms, spline shafts, gear sectors and pinions. 12 hob speeds, from 109 to 1259 R.P.M. Helix leads from .800" to 130". Generates gears with as few as 3, or as many as 650 teeth. Speed, feed, and indexing, each can be selected independently. Capacity from .050" to 6" O.D. of gear blank depending on gear characteristics. Free Bulletin No. 2544 provides full information.

2544

It's the

Hamilton

PRECISION SMALL-GEAR HOBBING MACHINE

THE HAMILTON TOOL COMPANY • 832 SOUTH NINTH STREET • HAMILTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 28

HOW TO INSURE YOUR COSTLY DIES . . .

DON'T buy "bargain-price" special die sets!

When you need a special die set it is usually for an expensive die . . . one that you really should protect.

The few dollars extra you may pay for a "Detroit-built" special are the cheapest insurance you can have that your costly die will get maximum protection.

Believe us—there is a lot more to a good special die set than some steel plate and a few pins and bushings.

The protection your costly dies get from Detroit-built die sets is not accidental. It is built into every die set we make—standard or special—and we've been doing it for 30 years.

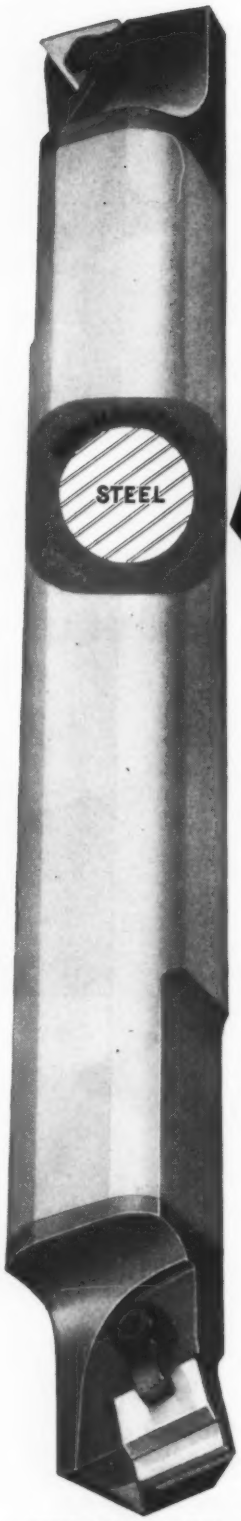
Sure, you can buy cheaper die sets, but they can be awfully expensive, too.

FFICES IN PRINCIPAL INDUSTRIAL CENTERS

Detroit DIE SET CORPORATION

2895 WEST GRAND BOULEVARD • DETROIT 2, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 29



DOUBLE-END TYPE

Jobs that "couldn't be done" before...

NOW easily handled with

The NEW KENNAMETAL*

ENCASED

Kendex* Boring Bars

If you have been having boring-bar troubles, here are some experiences that will interest you:

... At one of the nation's largest steel mills, the shop was unable to complete the contour boring of even a single steel tube, because of extreme chatter of the steel boring bar. A Kennametal encased Kendex boring bar was substituted . . . and the chatter was completely eliminated.

... At another plant, holes were being bored with a steel boring bar equipped with pilot. The holes were roughed at 950 RPM with a 1-inch per minute feed, and finished at 2-inches feed. Tool life averaged ten holes per grind. The tool cost per piece averaged $0.49 each for more than 4400 pieces over an 18-month period. Furthermore, at least 50% of the holes had to be reamed either to correct size or taper.

When a Kennametal encased Kendex boring bar was substituted, feeds were almost doubled—to 2 inches per minute roughing and 3½ inches per minute finishing. Tool life has been increased to 70 holes per cutting edge on roughing, and 80 holes per edge on finishing, with a tool cost per piece of $0.08. Holes are absolutely true to size and taper—the first time the shop had ever been able to hold dimensions with such consistency. It is anticipated that speeds and feeds can be substantially increased, which will effect further savings.

... A well-known equipment manufacturer is using a 1¾-inch Kennametal encased bar to bore cast steel at 350 feet per minute, .020-inch feed and approximately ½-inch depth of cut. The bar is used at full overhang —about 12 inches—and no chatter or bar deflection is experienced.

Kennametal Encased Kendex Boring Bars are available in a range of sizes. For information, write: KENNAMETAL INC., Latrobe, Pa.

*Trademark

C-3093

MINING, METAL AND WOODWORKING TOOLS

WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND KENNAMETAL ...Partners in Progress

ABRASION, CORROSION-RESISTANT PARTS

PERCUSSION AND IMPACT PARTS

CIRCLE INFORM-A-GRAM KEY NO. 30

Punch PRINTED CIRCUITS Cold...

with WALES Fabricator-Duplicator

The WALES **Fabricator** combined with WALES positive **Duplicator** is the modern, low cost answer to printed circuit hole punching. You get holes with sharp definition, clean walls and minimum bell mouth. This equipment is perfect for short runs from one piece to thousands. Change dies for hole sizes in seconds with a range up to 3½" dia. Accuracy is automatic and positive. Make your own templates, too, on the Fabricator. No need for drilling machines or jig-borers. The WALES Fabricator-Duplicator is a complete punching shop in itself.

SEND FOR BULLETIN NO. 27L

Complete specifications and capacities are yours for the asking.

WALES Strippit COMPANY

A UNIT OF HOUDAILLE INDUSTRIES, INC.

AKRON, NEW YORK

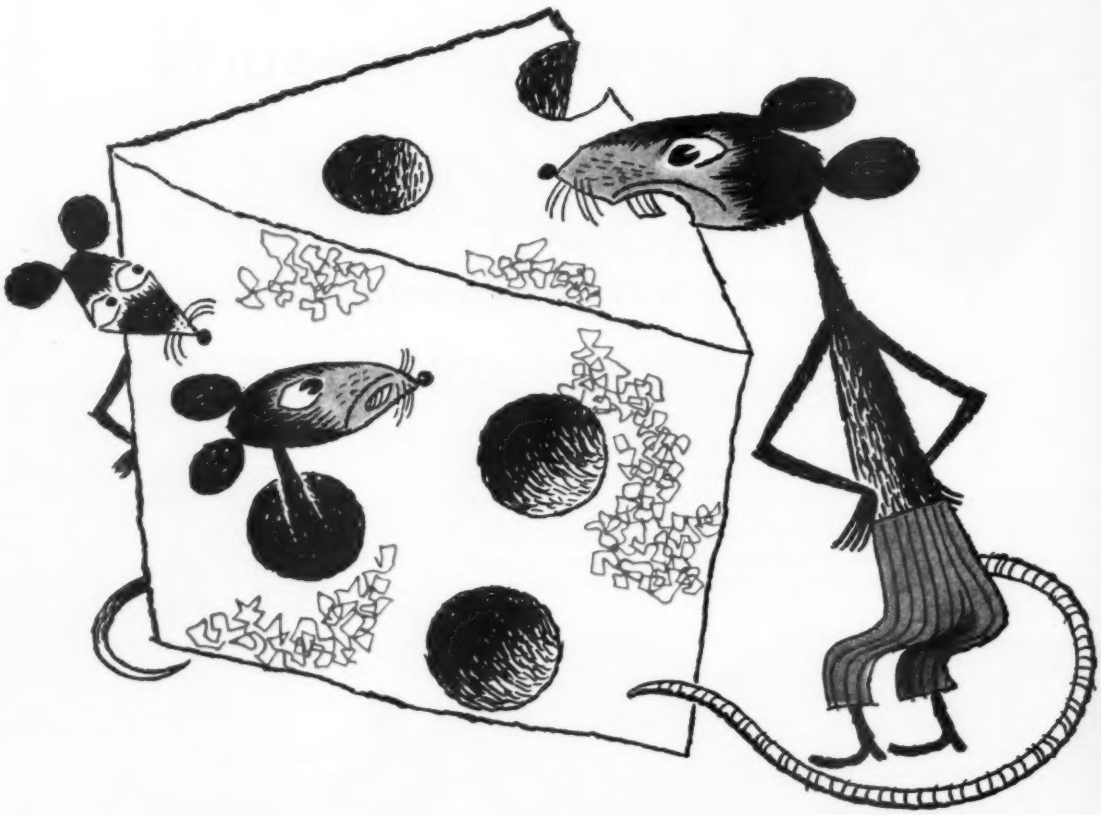
WALES-STRIPPIT OF CALIF., SOUTH GATE, CALIF.
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.

"...the Wales-Way is the PLUS-PROFIT way"

CIRCLE INFORM-A-GRAM KEY NO. 31

WHAT...

NO UNIVERSAL DRILL BUSHINGS?



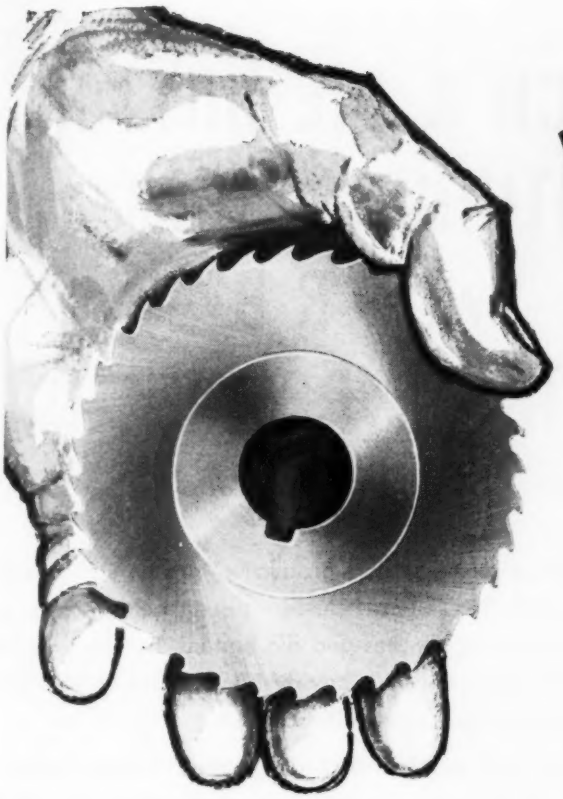
Wherever there are holes to drill using jigs or fixtures, it pays to specify Universal drill bushings. Machined from finest quality steel, Universal bushings have super-finished bores which lengthen tool life and reduce bushing wear over long production runs. Knurled heads provide quick, sure grip. Blended radii on top-inside diameters help prevent tool hang-up and breakage. Standard sizes and lengths in stock for immediate delivery.

FREE UNIVERSAL SELECTOR. Gives all engineering data for selection of all types and sizes of drill bushings up to 1¾" drill size. Send request on your company letterhead.

196

UNIVERSAL ENGINEERING CO. FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 32



no job too large . . .

or too small

M&M's complete line handles them all

REGARDLESS of the type or size of circular saw you require, there's a Motch & Merryweather blade to do the job . . . *better and faster.*

M&M's specially-developed Triple Chip tooth design distributes cutting strain, permits heavier feeds at higher speeds, greatly prolongs the life of each blade.

Your local M&M dealer stocks the complete line of Motch & Merryweather cut-off, slitting and slotting saws. In addition, he is always ready—with the help of M&M's Engineering Department—to assist you in solving unusually difficult sawing problems. Call him today.

FREE—*Send today for your copy of M&M's Circular Sawing Handbook, a pocket-sized guide to sawing operations.*

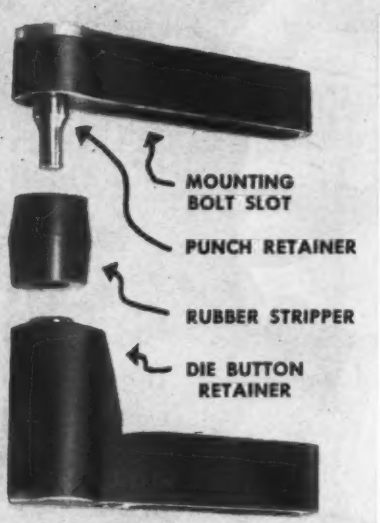
Q *Quality*
S *Service*
A *Availability*

MOTCH AND MERRYWEATHER

Cutting Tool Manufacturing Division
Cleveland 17, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 33

NOW! PUNCH & DIE BUTTON POSITIONING *Flexibility* with R-B *Flex-Mount* RETAINERS

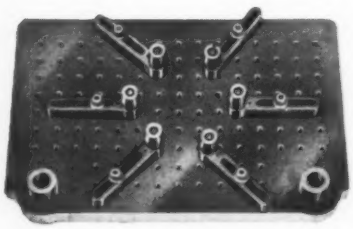


Cut your set-up time for short production runs on light gauge metals . . . R-B Flex-Mount Retainers permit quick, easy and flexible mounting of punches and die buttons. For, Flex-Mount Retainers are easily bolted in any desired position on T slotted or drilled and tapped commercial die sets.

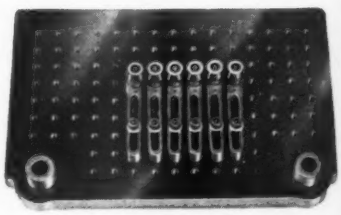
Standardized R-B punches and die buttons (round, square, oblong or special shapes to customer specifications) are used in these retainers. Stripping is accomplished with R-B rubber strippers or R-B rubber covered springs to eliminate costly metal strippers, retainer screws and springs.

Flex-Mount Retainers are available in many standard sizes.

TYPICAL *Flex-Mount* POSITIONING *Flexibility*



Shown are but two of an almost unlimited number of mounting arrangements that can be made with Flex-Mount Retainers.



Use R-B Engineering Service for Your Piercing Problems

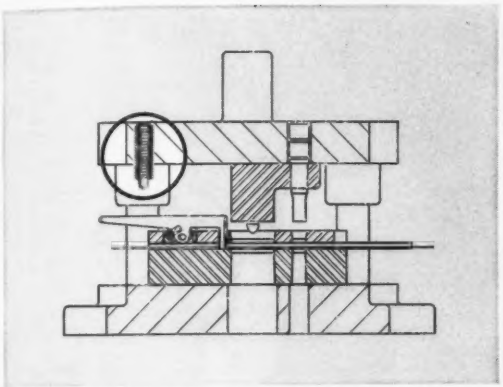
RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 88 • 26476 CAPITOL AVENUE • DETROIT 39, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 34

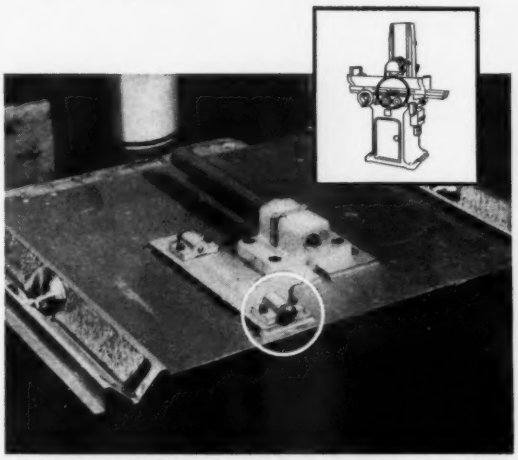
Practical Tooling Tips

Number 2 of a series.

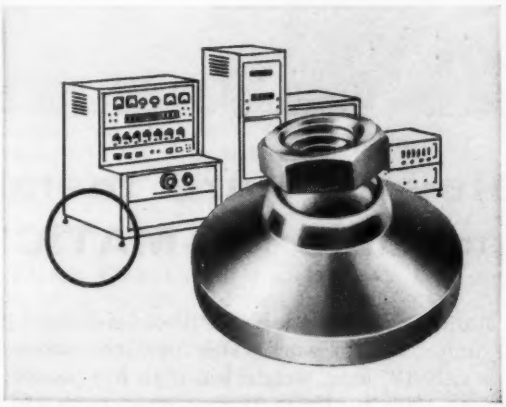
Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



TO STOP SMASHING DIE STOPS, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.



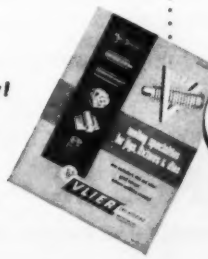
TO CUSHION SHOCK as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



TO LEVEL MACHINE TOOLS, electronic racks, benches, etc., use the *standard* Vlier leveling pad. The pad swivels to 7½° each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

TO GET NEW IDEAS on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

New catalog now ready! Send for your copy today.

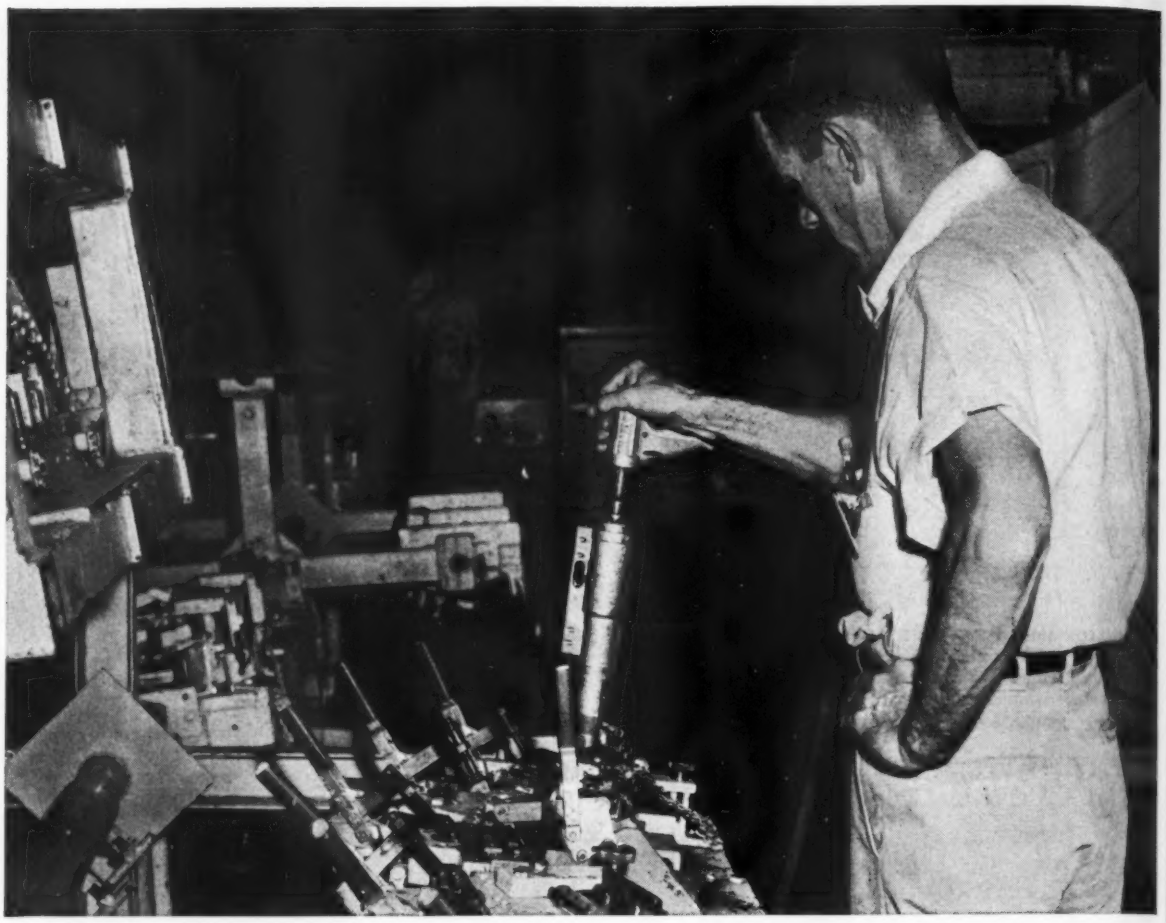


Insist on Vlier Tooling Accessories... there's still no substitute for quality!

VLIER ENGINEERING INCORPORATED

8900 Santa Monica Blvd., Los Angeles 46, California

CIRCLE INFORM-A-GRAM KEY NO. 35



Now drill accurate holes in hard metals easily . . . with the new portable "K-MATIC"*

"K-MATIC" FEATURES

- Develops up to 1000-lb. thrust
- Positive power feed .002″ or .003″ per revolution
- Simple single-lever operation
- 1¼″ stroke length
- Instant automatic bit return
- Adjustable depth stop

This man is standing by while a Keller Tool "K-Matic" portable drilling unit does its work. This new production line drilling unit is only 12″ long, weighs less than five pounds; yet it develops up to 1000-lb. thrust, has positive power feed and handles drills up to ⅜″.

Thrust is developed against a patented Keller Tool drill bushing tip that is easily locked to a jig by any of several simple methods. Hard metals, soft metals and sandwich construction are drilled so cleanly that reaming is often unnecessary.

Send now for complete information and specifications.

* Trade-Mark

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 36

Presenting . . . Representing . . .

The Landis Tool Co. has appointed three companies to represent them in the southern area. C. J. Harter Machinery Co. of Houston will distribute Landis grinders in southern Texas, George M. Meriwether, Inc. of Birmingham will serve in the Alabama and northwest Florida area, and the R. O. Deaderick Co. of Knoxville will distribute in Tennessee.

•

Appointment to represent the Colonial-Romulus Div'n of the Colonial Broach and Machine Co. are H. O. Monahan Co. of St. Louis, National Sales Engineering Corp. of Detroit, and Perine Machinery & Supply Co., Inc. of Seattle. Others include Scott Machine Tool Co. of Atlanta, Seaboard Machinery Co. of Los Angeles, and F. W. Strassman Co. of San Mateo, Calif.

•

Haven Machinery and Supply Co. of San Francisco has been named distributor for tool bits and related products manufactured by the Latrobe Steel Co., Special Products Div'n.

•

John R. Davis of Chattanooga, Tenn. is serving as distributor in the southeast for the Machine Div'n, Osborn Mfg. Co. The territory includes Tennessee, Virginia, Alabama, Florida, Georgia, North and South Carolina, and Mississippi.

•

Edward Klewicke has been appointed by the MacLean-Fogg Lock Nut Co. to handle M-F lock nut sales in most of the Michigan area.

•

Exclusive representatives of the Alpha Systems, Inc. for the western Pennsylvania, eastern Ohio, and northern West Virginia area is the Ritter Engineering Co., Inc. of Pittsburgh.

•

The Meredith Machinery Co. of Englewood, N. J. has been named representative for the Minster Machine Co. in the New York metropolitan area and the northern section of New Jersey.

•

Niagara Machine & Tool Works has announced the appointment of the Smith-Courtney Co. of Richmond, Va. as distributor in Virginia and North Carolina.

Here are the
STUPALOX
oxide cutting tools
which have produced
such sensational results!

Production increased... costs greatly reduced... and performance is better

ACTUAL CASE HISTORIES were made on the use of Stupalox oxide cutting tools in a variety of applications. Wherever aluminum oxide cutting tools are properly used, production goes up from 2 to 10 times and machining costs go down from 30% to as much as 75%. Consequently, capital investment in machines and floor space can be reduced.

FASTER SPEEDS, SMOOTHER FINISH, and longer tool life are bonus benefits. That's because Stupalox cutting tools have exceptional wear-resisting properties. They retain their strength at 2000°F and higher. They're resistant to the strongest acids and chemicals normally encountered in machining operations, and nonmagnetic. For complete details, write for Catalog 257.

STUPAKOFF DIVISION OF
The CARBORUNDUM Company
WRITE DEPT. TP, LATROBE, PENNSYLVANIA
CIRCLE INFORM-A-GRAM KEY NO. 37

Tough 2½" diameter mandrel at Rc 44 on 1150 ton brass extrusion press. Scovill Manufacturing Co.

Mandrel of HALCOMB 218 retains toughness and hardness at hot work temperatures...

This mandrel is made of Halcomb 218—a tough, air-hardening hot work steel. Halcomb 218 is suitable for tools like this which require a higher degree of toughness at moderately elevated temperatures than is obtainable with the tungsten types of hot work steels. And Halcomb 218 *retains both* its hardness and strength at these temperatures.

For example, at a hardness of Rc 44, Halcomb 218's Charpy Impact Strength is 33 ft-lbs at 500F. And it will retain this hardness after 1 hour, after 10 hours and even after 100 hours at temperatures up to 900F.

Properties like these cut tooling costs. The mandrel shown above is good for 1200 pushes, for example, and even then all it needs, usually, is repolishing before being used again.

Halcomb 218 is particularly useful for all hot work operations on which drastic coolants are used. It even resists breaking very successfully when water cooled in operation. If these sound like advantages you can use, call your local Crucible representative for more complete data. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

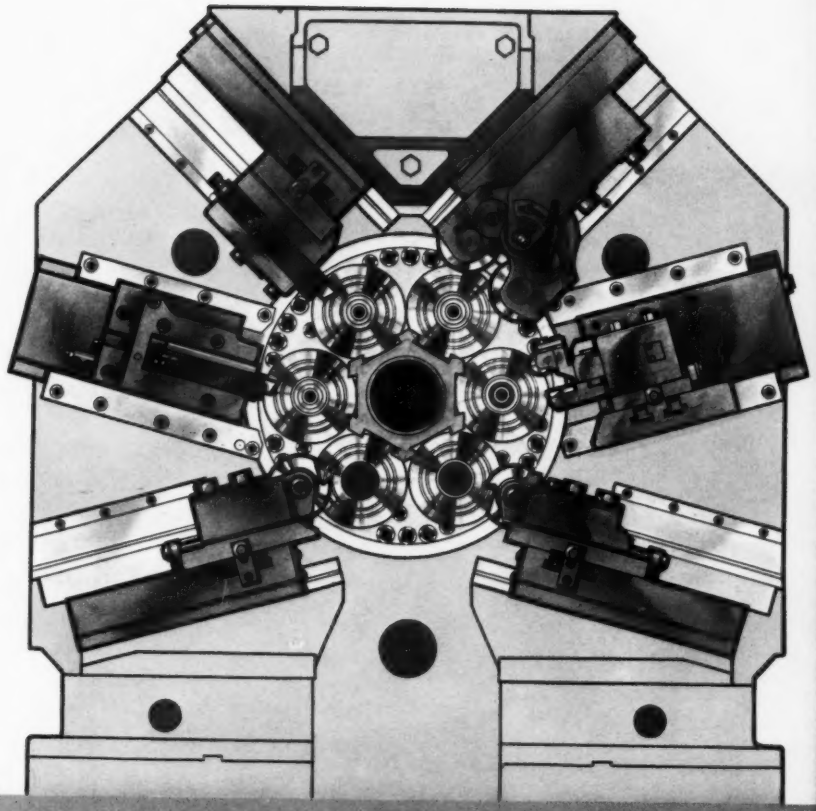
Canadian Distributor—Railway & Power Engineering Corp., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 38

Look at New Britain's

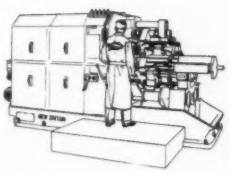
new cross slide arrangement

Independent radial cross slides in *all* positions, providing maximum clearance for more cross slide operations.

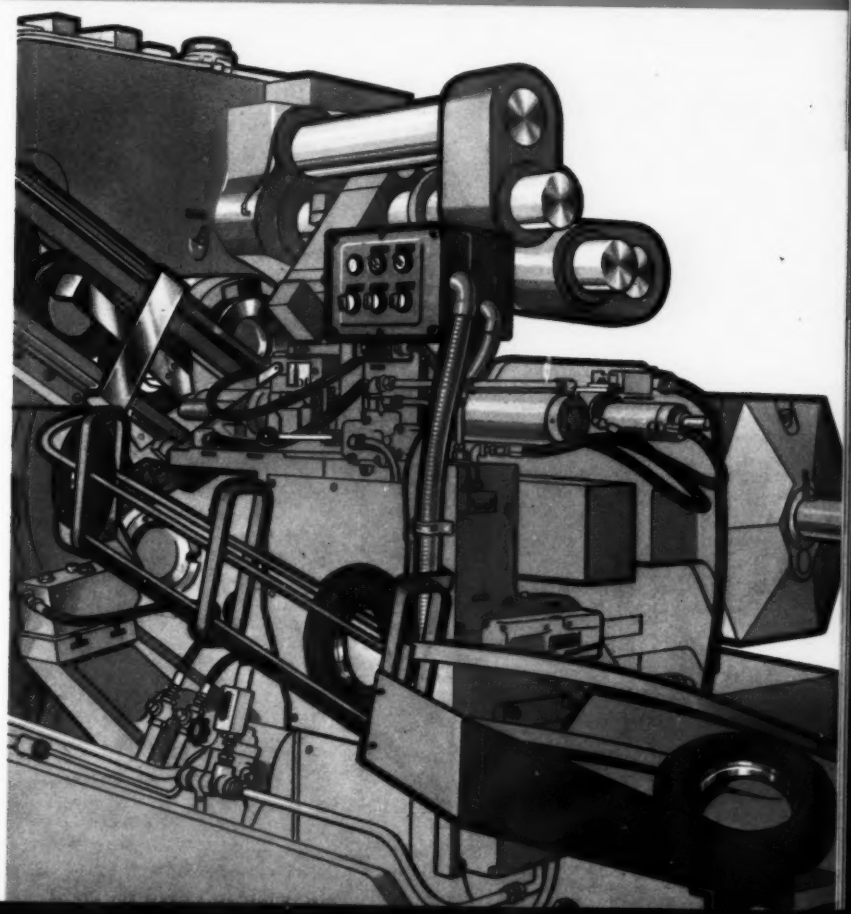


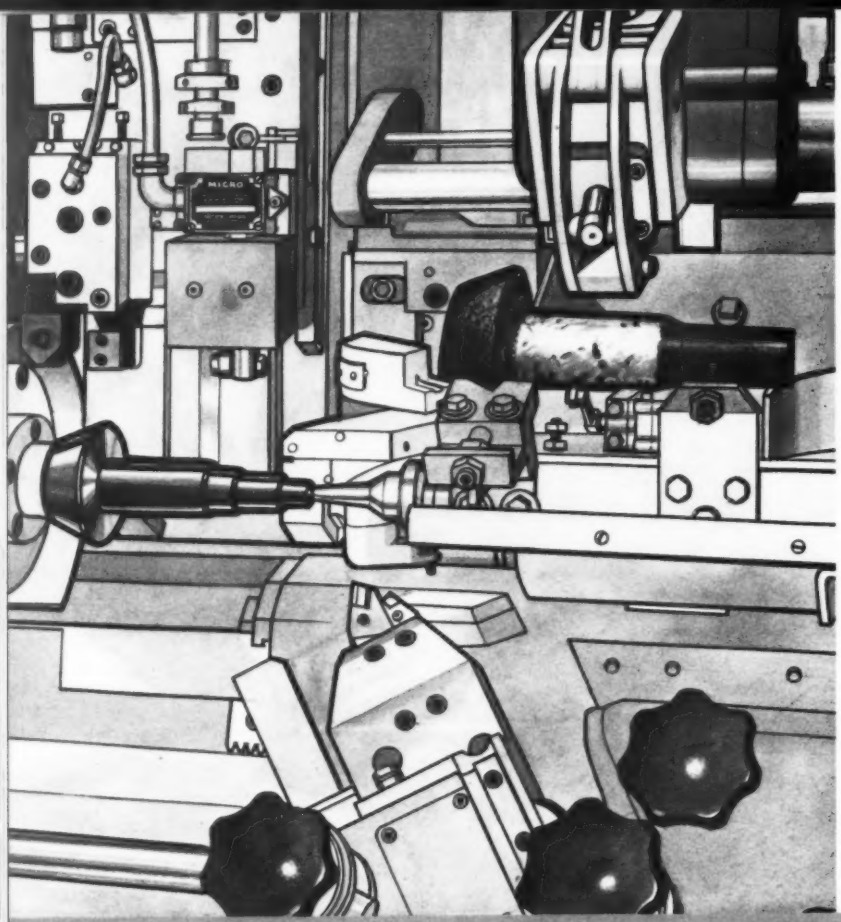
Look at New Britain's

open-end chucker design



Greater accessibility for all applications and particularly well adapted to automatic handling of pieces. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

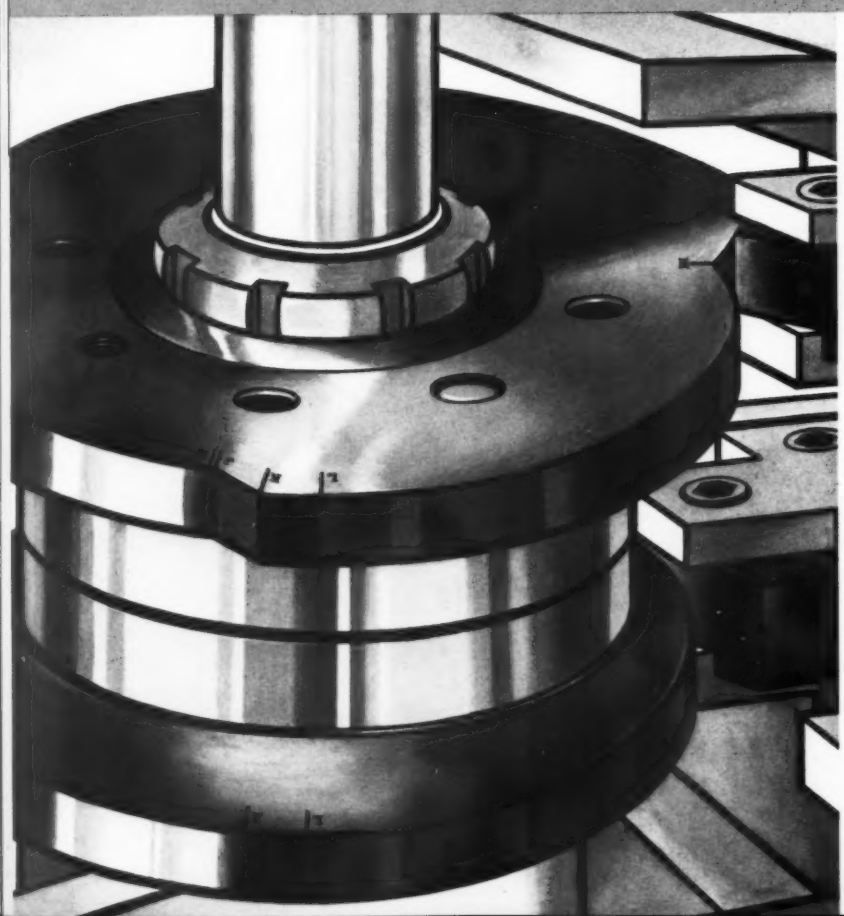




Look at
Automatic Loading on

New Britain +GF+

This basic optional feature can make money for you whether you are working with forgings, bar slugs, or bar stock.



Look at New Britain's

cam-controlled boring machine

When you are working to tenths there is no substitute for the positive tool control that only precision cams provide. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

Presenting the new

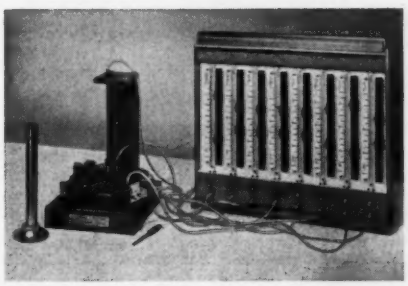
DEARBORNAIRE

COLUMN-TYPE AIR GAGING INSTRUMENT

Never before has there been an air gage instrument quite like the new Dearbornaire! For it incorporates a host of advanced design features that give you greater versatility and ease of operation with finer accuracy, minimum maintenance and lower gaging costs.

The characterized internal taper of its exclusive new glass tube assures positive linear accuracy over the full extent of the calibrated scales. Its zero-centered scales permit faster and easier reading . . . whether used for normal parts inspection, for statistical quality control, or as a tool setting gage. Interchangeability of its basic component parts simplifies conversion from one amplification to another . . . saves time, cuts costs. What's more, Dearbornaire's new higher rated pressure system and built-in circuit restrictions make it virtually self-cleaning . . . eliminate nuisance interruptions for service, reduce down-time to a minimum.

Single and multiple column instruments available now in standard amplifications of 1250-1, 2500-1 and 5000-1. Free demonstration arranged upon request. Write for complete information today!



● Multiple column Dearbornaire instrument and a special fixture equipped with Dearborn contact cartridges to check eight close tolerance dimensions at one time.

AIR GAGE DIVISION **DEARBORN GAGE COMPANY**

22038 BEECH STREET DEARBORN, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 41

Cut Costs with SHEFFIELD Adjustable AIR GAGE TOOLING

Especially for Short Runs and Emergencies

SUCH AS:

- **Aircraft manufacturers, subcontractors and job shops having limited production.**
- **Accidental damage to a vitally needed single purpose gage.**
- **An unexpected engineering change involving part size.**
- **A short run of special parts for which no gages have been provided.**
- **A mistake or failure in ordering the needed single purpose gages.**
- **Sudden need for process gages at the production machines.**

Don't let any of these situations cause costly scrap, delays or embarrassing confusion in inspection, in the shop or in the toolroom. A small investment in the tooling here illustrated is your best insurance against unpredictable production losses.

Write Div. 20 for descriptive engineering data. THE SHEFFIELD CORPORATION, Dayton 1, Ohio, U.S.A.

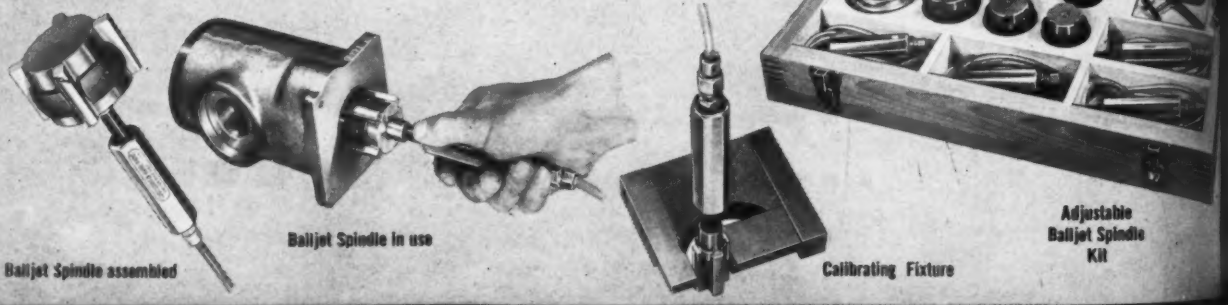
All items shown here are stocked for immediate delivery— no waiting.

Economical, Adjustable Balljet Spindle Kit

In 5 minutes you can assemble, for precision gaging, a spindle for ANY SIZE hole from 1" to 3" in diameter.

Consider economy for a moment. If the holes you may encounter vary in increments of .001", this Kit provides the equivalent of 2000 Spindles at a unit cost of less than a dollar. If those increments are .0001" you have available 20,000 Spindles at about a dime each. That is real economy.

No auxiliary equipment needed except conventional gage blocks—NOT EVEN ONE MASTER SETTING RING.



Balljet Spindle assembled

Balljet Spindle in use

Calibrating Fixture

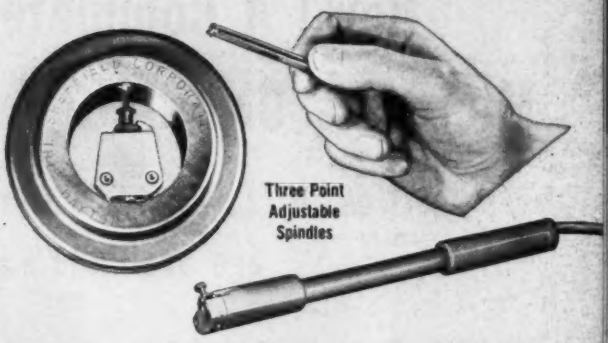
Adjustable Balljet Spindle Kit

Adjustable Airebore Gage

The Airebore Gage can be set precisely to measure any diameter hole from 3″ to 12″. And like the Adjustable Balljet Spindle, it is set up with a calibrator and gage blocks. No master setting rings are needed.

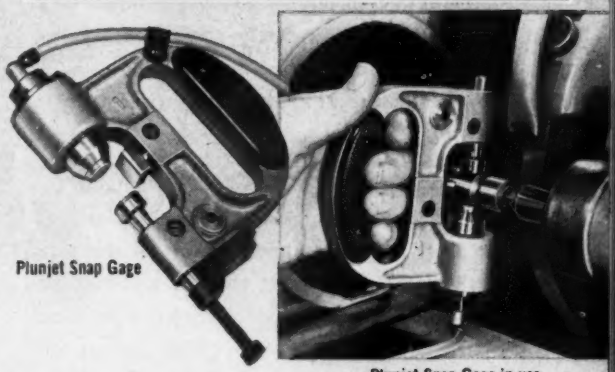
The Airebore Gage is self-centering—needs only to be rocked in place for precision action. It is light in weight with all contact surfaces of tungsten carbide—nothing to wear out.

Three-Point Adjustable Spindles



The Three-Point Adjustable Spindles, four of them, cover respectively the ranges, 3/8″ to 5/16″, 5/16″ to 1″, 7/8″ to 1½″ and 1½″ to 3″. They can be set up with gage blocks.

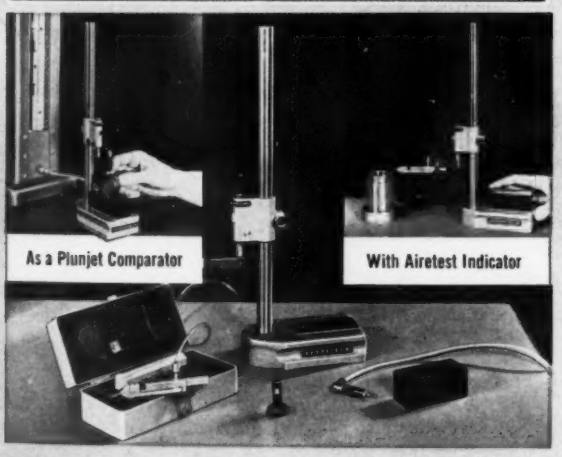
Plunjet Indicator Snap Gage



The Plunjet Gaging Cartridge may be substituted for the Dial Indicator to assure consistent, repetitive readings, especially when tolerances are .001″ or less.

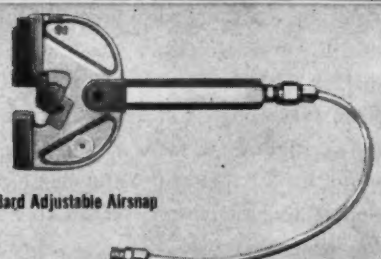
Twelve Plunjet Snap Gage models cover the gaging range of 0″ to 12″. Larger sizes are available on special order.

Airetest and Plunjet Stand



A new, highly versatile stand accommodates a dial indicator or an Airetest Indicator—also converts to a comparator by using a Plunjet and anvil as illustrated.

Standard Adjustable Airsnaps



The Standard Adjustable Airsnap in 17 models covers the range .2500″ to 5.500″. Up to 3.000″ the adjustable anvil has a maximum adjustment of ¼″. Above that the maximum is ½″.

the SHEFFIELD corporation

of Bel[illegible]

7839R

Now! A Complete Line of Self-Locking Microsize UNBRAKO Socket Cap and Set Screws

Nos. 0, 1, 2 and 3 in alloy steel and stainless steel are available with the Nylok* feature

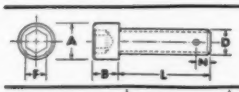
You effect major economies in time and money when you design and assemble small devices with self-locking microsize UNBRAKO socket screws. These close tolerance screws won't work loose. They simplify standardization of small devices where maximum reduction of weight is required without sacrifice of strength. They eliminate the necessity of designing costly special screws to fasten tiny parts in compact assemblies and they prevent the waste of production time while waiting for delivery of special screws.

In addition to having the overall advantages of microsize UNBRAKO socket screws, these screws can be used in holes tapped in soft or die cast materials without stripping threads and ruining expensive work. Also the set screws can be used with hardened shafts, since they lock against the threads of the tapped hole.

All UNBRAKO socket screws can be supplied with the self-locking Nylok feature. The UNBRAKO with Nylok is a single self-locking unit. No auxiliary locking devices are needed. Seated or not, the screw locks positively wherever wrenching stops, won't work loose—because the tough resilient nylon pellet forces mating threads together.

Ask your authorized industrial distributor for details today. He carries complete stocks of self-locking UNBRAKO socket screws (caps and sets from #0 through 1 in., button heads #4 through ⅜ in., flat heads from #4 through ¾ in.). Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 36, Pa.

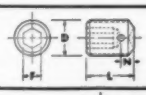
*T.M. Reg. U.S. Pat. Off., The Nylok Corporation



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO Socket Cap Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque Max. prev. on	Torque 1st off stat. min.	Torque 5th off stat. min.
#0	A .104	—	80	1/8	—	.047	5.5	14.0★	7.0★
	B .060	—	80	3/16	—	.047	5.5	14.0★	7.0★
	D .060	—	80	1/4	—	.047	5.5	14.0★	7.0★
	F .050	—	80	3/8	—	.047	5.5	14.0★	7.0★
#1	A .118	—	72	1/8	—	.047	11.0	28.0★	14.0★
	B .073	—	72	3/16	—	.047	11.0	28.0★	14.0★
	D .073	—	72	1/4	—	.047	11.0	28.0★	14.0★
	F .050	—	72	3/8	—	.047	11.0	28.0★	14.0★
#2	A .140	56	—	3/16	.063	—	24.0	3.0	1.5
	B .086	56	—	1/4	.063	—	24.0	3.0	1.5
	D .086	56	—	3/8	.063	—	24.0	3.0	1.5
	F 1/16	56	—	1/2	.063	—	24.0	3.0	1.5
#3	A .161	48	—	3/16	.063	—	40.0	6.5	3.0
	B .099	48	—	1/4	.063	—	40.0	6.5	3.0
	D .099	48	—	3/8	.063	—	40.0	6.5	3.0
	F 5/64	48	—	1/2	.063	—	40.0	6.5	3.0

★Measured in in.-gm. (those not marked with a star are measured in in.-oz.)



HEAT-TREATED ALLOY STEEL
Self-Locking Microsize UNBRAKO Socket Set Screws
Class 3A Threads

Screw Size		Threads per in. NC	Threads per in. NF	L Over-all Length	N Pellet Location NC	N Pellet Location NF	Torque Max. prev. on	Torque 1st off stat. min.	Torque 5th off stat. min.
#0	D .060	—	80	3/32	—	.047	5.5	14.0★	7.0★
	F .028	—	80	1/8	—	.047	5.5	14.0★	7.0★
		—	80	5/32	—	.047	5.5	14.0★	7.0★
		—	80	3/16	—	.047	5.5	14.0★	7.0★
		—	80	1/4	—	.047	5.5	14.0★	7.0★
#1	D .073	—	72	1/8	—	.062	11.0	28.0★	14.0★
	F .035	—	72	5/32	—	.062	11.0	28.0★	14.0★
		—	72	3/16	—	.062	11.0	28.0★	14.0★
		—	72	1/4	—	.062	11.0	28.0★	14.0★
#2	D .086	56	—	1/8	.062	—	24.0	3.0	1.5
	F .035	56	—	5/32	.062	—	24.0	3.0	1.5
		56	—	3/16	.062	—	24.0	3.0	1.5
		56	—	1/4	.062	—	24.0	3.0	1.5
#3	D .099	48	—	5/32	.093	—	40.0	6.5	3.0
	F .050	48	—	3/16	.093	—	40.0	6.5	3.0
		48	—	1/4	.093	—	40.0	6.5	3.0

★Measured in in.-gm. (those not marked with a star are measured in in.-oz.)

Self-locking microsize UNBRAKO socket cap and set screws are available in sizes #0 through #3, in heat treated alloy steel (plated or unplated) and stainless steel, at your authorized industrial distributor. He also carries a complete stock of other self-locking UNBRAKO socket screws.

We also manufacture precision titanium fasteners. Write for free booklet.

sps **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co., Inc. • Cooper Precision Products • Standco Canada Ltd. Unbrako Socket Screw Co., Ltd.

CIRCLE INFORM-A-GRAM KEY NO. 44

Acme-FETTE

NEW SERIES - "N" SELF-OPENING THREAD ROLLING HEAD

lets you use your present equipment

(either rotating or stationary spindles)

for rolling threads from the end

VERSATILE—Same head can be used on any type of turning equipment—either rotating or stationary spindles—on all jobs which permit clearance for front plate. Reduces secondary operations.

FAST—Thread rolling speeds are equal to turning speeds with high-speed tool steels—on all ferrous and most non-ferrous materials; up to 5 times faster than conventional thread cutting methods.

SMOOTH, TOUGH, EXTREMELY ACCURATE—Metal flows to full depth of thread; forms a dense, uniform structure with no cratering at the crest; provides a burnished thread surface remarkably resistant to wear and corrosion.

NO CHIP PROBLEM—Thread Rolling with an Acme-Fette is ideally suited to multiple-spindle tooling setups.

FOR EITHER LONG OR SHORT RUNS—Production records (names on request) prove substantial cost savings due to easier setup, less down time and more mileage per set of rolls.

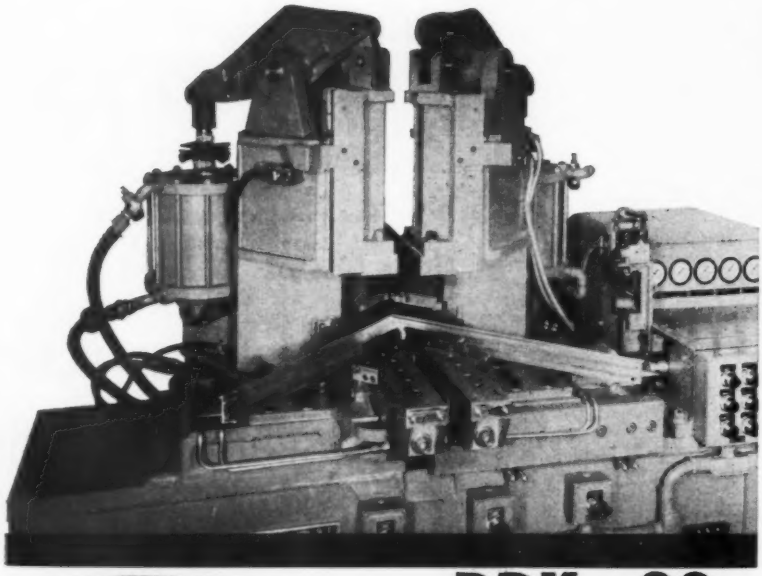
WIDE RANGE—8 Acme-Fette Thread Rolling Heads provide for capacities ranging from 1/8" to 2".

Check where Acme-Fette can help you keep more of your present equipment busy. Send sample or print for our recommendation — or write for your copy of Bulletin NAF-57

ACME-FETTE NEW SERIES "N" HEAD (Size 00)
Rolling No. 6-32 Class 3 Thread on a Single Spindle Automatic Screw Machine.

National Acme

THE NATIONAL ACME COMPANY
169 EAST 131ST ST., CLEVELAND 8, OHIO
SALES OFFICES: Newark, Chicago, Detroit
CIRCLE INFORM-A-GRAM KEY NO. 45



Darwin

PRK • 33 TOOL STEEL

(Cobalt, High Carbon, High Chrome)

***Holds its edge at 1000° F.!**

Above is the Thomson Synchro-Matic Welder performing a miter weld on an aluminum window extrusion. "Pinch-off" dies of PRK-33, a Thomson development, support the work close to the point of weld. After welding, this PRK-33 die moves in to pinch off the flash close to the surface of the work. Eliminates most cleaning and finishing of the weld.

After testing many die steels, Thomson now specifies PRK-33. They have found PRK-33 to be the finest high carbon, high chrome, with cobalt, die steel available. Its production record, its ability to hold a hard edge at high temperatures far surpassed all other die steels tested. Heat treated and double drawn at 980°F. gives PRK-33 a secondary hardness of 59-61 Rc.

Want these qualities in the dies you buy?—Write for full information NOW!

Complete Line of highest grade Tool Steels, including PRK-33, DARWIN No. 1, NEOR, MINEOR, OHT, "MT6" and various grades of Hot Work Specialty Steels. Furnished in Bar Stock, Forgings, and Sand Castings, Drill Rod, Flat Ground Stock and Tool Bits.

Bulletin on Request.

DARWIN & MILNER Inc.

highest grade tool steels

2345 ST. CLAIR AVENUE ★ CLEVELAND 14, OHIO

• 1610 W. FIRST AVENUE • COLUMBUS, OHIO •

REPRESENTED BY

ZIV STEEL & WIRE CO., CHICAGO • DETROIT • ST. LOUIS • INDIANAPOLIS • TOLEDO • MILWAUKEE • M. G. OPP COMPANY, NEW YORK CITY • PECK STEEL & DIE SUPPLY COMPANY, LOS ANGELES • CHARLES B. WEBSTER, PLAINVILLE, CONNECTICUT • CHARLES W. BRINGMAN, ORLANDO, FLORIDA

CIRCLE INFORM-A-GRAM KEY NO. 46

The National Acme Company has announced the election of **Robert R. Rhodehamel** to the office of vice president and general sales manager.

◆

Simpson Electric Co. of Chicago announces the addition of **Frank Hadrick** to its engineering staff as chief field engineer.

◆

Chester S. Johns is now on the executive staff of Buhr Machine Tool Co. and occupies the post of sales manager.

◆

New general sales manager for the Taft-Peirce Mfg. Co. is **Wendell F. Carney. Richard R. Read** has become branch manager of the Detroit office, and **Herbert A. Potter** takes over as Rochester sales manager.

◆

Lindberg Engineering Co. announces the appointment of **Robert H. Warel** as service manager for the Cleveland territory. Mr. Warel replaces **Robert Lafferty** who has been appointed district sales manager of the San Francisco territory.

◆

G. K. Foster takes over as a new socket screw field representative in the Cincinnati area for The Bristol Co. **C. A. Rust** is the representative in Los Angeles, and **R. E. Helsabeck** in Houston.

◆

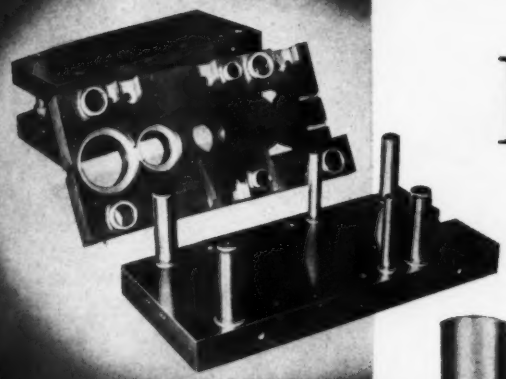
Walter H. Brown has been named to the newly created post of midwest sales coordinator by Standard Pressed Steel Co. **Thomas A. Breen** succeeds Brown as Chicago district sales manager. Brown will deal with sales and service activities in the 13 state area consisting of the company's Chicago, Cincinnati, and Cleveland district sales territories.

◆

James R. Uber has been named district manager for the Pittsburgh area by Colonial Broach & Machine Co.

◆

James P. Stine, former Thor service engineer and east coast zone manager, has been promoted to manager of the New York branch of Thor Power Tool Co. Stine succeeds **W. J. McGraw,** recently named manager of Thor's electric tool division. **A. V. Moroz** has been appointed electric tool sales manager for the Chicago Branch of the company, succeeding **Arthur H. Nelson,** who has retired.



Big or Small

we make them all...

JUST OFF THE PRESS...and yours for the asking: a simple easy-to-use catalog of all standard and special die sets and die maker's supplies.

There are no limits on size...thanks to its facilities, Dieco can make special die sets for any press built.

And to speed these die sets to you, we have now made it possible for your local Dieco branch or dealer to give you an on-the-spot quotation on any special die set. Without having to refer back to the main plant, he can save you days on delivery.

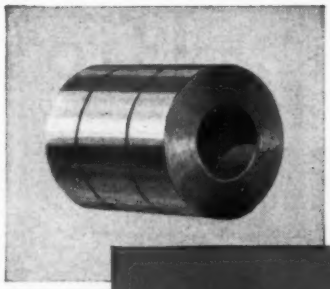
Dieco service is not only fast, it's complete. Our branches stock all standard die sets and a broad line of die maker's supplies. For more information call your Dieco dealer or branch or write us directly.

dieco®

DIE SETS

E. W. BLISS CO.
DIE SUPPLY DIVISION
Cleveland • Ohio

CIRCLE INFORM-A-GRAM KEY NO. 47



FROM COIL..

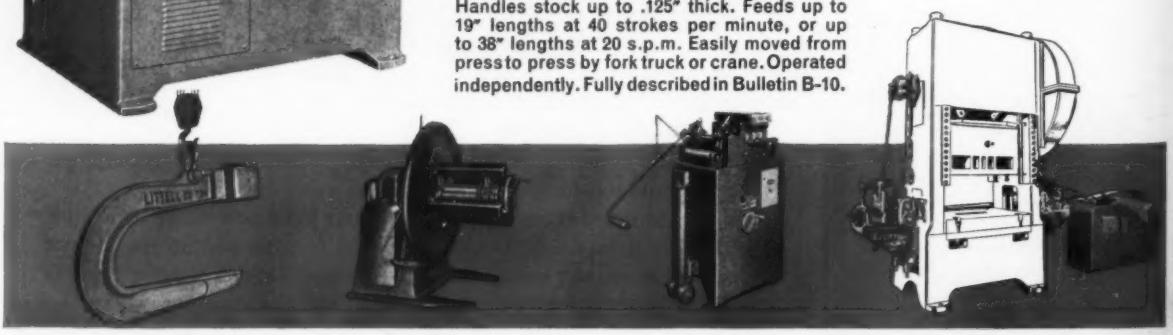
TO STAMPING..

THE *LITTELL* LINE

Speeds Production, Cuts Cost

Ever since the first coil stock came out of the mill, Littell straightening and feeding equipment has made it practical and profitable to use. The pioneers of low cost, automatic punch press operation depend on Littell Hooks, Reels, Straighteners and Roll Feeds today, as they have from the start. The Littell line has grown up with the needs of the modern pressroom to become the complete line, the standard-bearer of its field. You will find in Littell equipment the key to more flexible, more productive, and more profitable operation in your own pressroom.

No. 418-HRP HYDRAULIC DRIVEN FEEDING AND STRAIGHTENING MACHINE
Automatically straightens coil stock and feeds to any type punch press or square shear. Handles stock up to .125" thick. Feeds up to 19" lengths at 40 strokes per minute, or up to 38" lengths at 20 s.p.m. Easily moved from press to press by fork truck or crane. Operated independently. Fully described in Bulletin B-10.



HOOKS . . .
with coil lifting capacities of 1,000 to 40,000 lbs.

REELS . . .
Spindle Reels with coil capacities from 300 lbs. to 40,000 lbs. Coil cradle reels for coils up to 30,000 lbs.

STRAIGHTENERS . . .
straighten coil stock from 1" to 90" wide, from .010" to .125" thick.

AUTOMATIC ROLL FEEDS
. . . serve all types of presses, handle all widths and thicknesses of stock. Used with compound, single and progressive dies.

F. J. LITTELL MACHINE CO.
SPEED WITH SAFETY

REELS · STRAIGHTENING AND FEEDING MACHINES · SHEETING LINES · ROLL FEEDS · COIL CRADLES
DISTRICT OFFICES: DETROIT, CLEVELAND

4197 N. Ravenswood Ave. • Chicago 13, Illinois

THE LITTELL CATALOG No. 56 tells the complete story. Write for your free copy.

CIRCLE INFORM-A-GRAM KEY NO. 48

Announcing....

SPECIAL GAGE DEPARTMENT

SIZE CONTROL COMPANY
makes Special Gages on a "Design and Build" basis or to your Gage Print!

SIZE CONTROL is equipped to supply special gages in limited or production quantities. Gages can be made to customer's specifications — or recommendations made without obligation.

Send us your requests for all types of built-up, snaps, indicating, fixture and plain taper plug and ring gages for free quotation.

For standard gages, send for our catalog 57. FREE!!

SIZE CONTROL COMPANY

2500 W. Washington Blvd. **MOnroe 6-6710** **Chicago 12, Illinois**

Division of
AMERICAN GAGE & MACHINE CO.

MIDWEST GAGE LABORATORY
Inspection Service for Industry

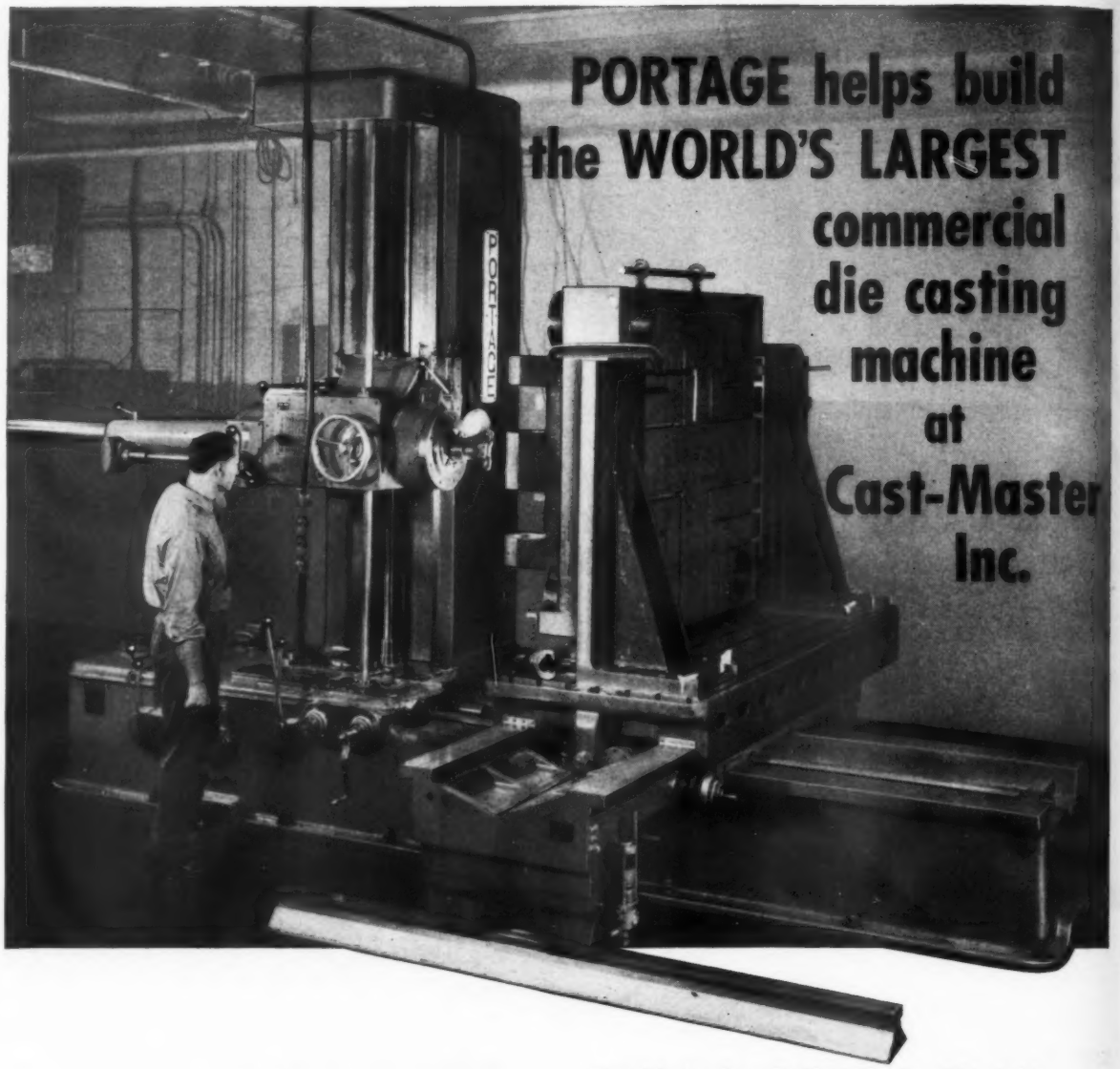
WACKER SALES AFFILIATE
Inspection Equipment

SIMPSON ELECTRIC CO.
Electrical Test Equipment

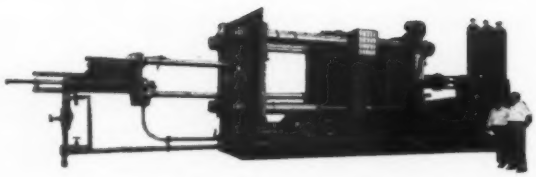
WALSH PRESS & DIE CO.
Punch Presses

Engineering Representatives in Principal Cities

CIRCLE INFORM-A-GRAM KEY NO. 49



PORTAGE helps build the WORLD'S LARGEST commercial die casting machine at Cast-Master Inc.



The world's largest Die Casting Machine is 10 feet wide, 13 feet 4 inches high and 42 feet long. Gross weight is 205,000 lbs.

Cast-Master, Inc., Bedford Heights, Ohio holds the distinction of manufacturing the world's largest commercial die casting machine . . . and Portage Horizontal Boring, Drilling and Milling Machines played an important part in its construction. The first Portage Mill was purchased by Cast-Master in 1946, today, four machines are in daily use. Both management and shop personnel report very excellent performance and low maintenance costs on the Portage Mills. Ask your local representative about the NEW *over-all* heavier 4" or 5" machines or write direct for literature . . . and remember . . . dollar for dollar you can't beat a PORTAGE.

THE Portage MACHINE CO.

1036 Sweitzer Avenue • Akron 11, Ohio

Representatives in Principal Cities

BUILDERS OF PRECISION MACHINE TOOLS, SPECIAL AND PRODUCTION MACHINERY SINCE 1916

CIRCLE INFORM-A-GRAM KEY NO. 50

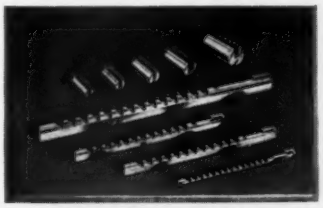
PLASTIC TAP BOXES

COMPLETE LINE OF STANDARD & SPECIAL TAPS

PROTECTED QUALITY

It's apparent how Threadwell TAP quality is protected by the original plastic tap package shown above. BUT . . . the quality of ALL Threadwell products is ***triple protected.*** At the ***factory*** by rigid process and individual final inspection . . . in ***transit and storage*** by advanced packaging and clear labeling . . . and in ***use*** by Threadwell Field Engineers strategically located nation wide to help you with cutting tool and gaging problems on the job.

ADJUSTABLE ROUND, 2-PIECE & HEXAGON DIES



KEYWAY BROACHES & SETS

COMPLETE LINE OF HIGHEST PRECISION GAGES

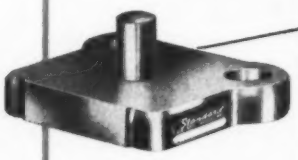
THREADWELL DISTRIBUTORS, too, are strategically located to serve you promptly, properly, and well.

THE FINEST IN CUTTING TOOLS & GAGES

CIRCLE INFORM-A-GRAM KEY NO. 51

Stan the die set man says:

These details make the difference...



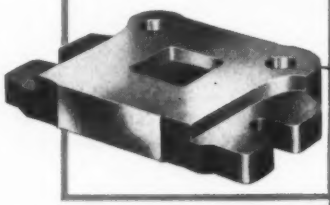
Punch and die holders fully stress relieved — when you lay out work on a "Standard" die set, the dimensions "stay-put" because "Standard" uses a metallurgically correct stress relieving process which produces great dimensional stability.

Bushings — hardened, ground, and honed — provide full-length bearing for longer wear. Pre-shrunk in deep freeze for stress-free assembly into punch holder.

McVey Design Precision Posts (pat. applied for) for fast, easy assembly and disassembly of die sets — without hammering or pounding.

Posts chrome-coated for low friction and long wear.

Posts pre-shrunk in deep freeze for precision assembly into die holder holes. Bond of post in plate helped by Pentrate finish of post end.



Special Machine Work further stress relieved for added assurance of dimensional stability and precision fit of posts and bushings.

Send for Die Set Comparison Chart and see for yourself why experienced tool and die makers specify and insist on "Standard" every time.

- YES, **there's a difference in die sets and "Standard" makes the difference!**

MAIL THIS COUPON NOW

STANDARD DIE SET MFRS., INC.
1501 ELMWOOD AVENUE
PROVIDENCE 7, R. I.

☐ Please send Comparison Chart

☐ I would also like a FREE sample of "Standard" die makers grease.

Name .....

Company .....

Address .....

New York • Philadelphia • Buffalo • Detroit • Grand Rapids • Indianapolis • Louisville

Coming Events

Dec. 1-6. The American Society of Mechanical Engineers. Annual Meeting. Statler and McAlpin Hotels, New York City.

•

Dec. 5, 9, and 12. National Institute of Management. One-day seminars on Economics of Machine Tool Retention or Replacement. Dec. 5 — Hotel Cleveland, Cleveland. Dec. 9 — Sheraton-Lincoln Hotel, Indianapolis. Dec. 12 — Edgewater Beach Hotel, Chicago.

•

Dec. 9-12. Eastern Joint Computer Conference. Sheraton Park Hotel, Washington, D. C.

•

Jan. 6-8. IRE, ASQC, AIEE, and RETMA. Fourth National Symposium on Reliability and Quality Control. Hotel Statler, Washington, D. C.

•

Jan. 13-17 and Feb. 24-28. Machine Design Seminars. The Lincoln Electric Company, Cleveland, Ohio.

•

Jan. 27-30. Plant Maintenance and Engineering Conference and Show. International Amphitheatre, Chicago.

•

Jan. 27-Feb. 6. University of California, University Extension. Two-week course on higher management responsibilities. Los Angeles Campus, University of California.

•

Jan. 28-31. Society of the Plastics Industry, Inc. 14th Annual Technical Conference. Sheraton-Cadillac Hotel, Detroit.

NECROLOGY

Edward J. Byrnes, Jr., assistant general manager of sales, Eastern Division of The Colorado Fuel and Iron Corporation, died Oct. 8 at the Palmer Spring plant of CF&I in Palmer, Mass.

Erich M. Hofmann, president of E. Hofmann Engineering Co. and second vice president of the Cleveland Engineering Society, died suddenly at Cleveland Clinic Hospital on Oct. 24.

CIRCLE INFORM-A-GRAM KEY NO. 52

What's the job?

We've got the file!

Flat files and round, files for wood, files for metals, files for plastics—we make a file in the exact shape, size and cut to meet your every need.

Pictured above are only a few of our files—a tiny sampling of the 6000 Nicholson and Black Diamond varieties available through your Industrial Distributor.

Our business is making the world's finest files—and making them for every job that demands a file, regardless of size, shape, cut, contour.

Each one of these 6000 varieties is presently finding active application in shops throughout the world. That's why we continue to make them. And that's why it's easier for you to buy Nicholson or Black Diamond files. No matter what your job is, we make just the file to help you do it efficiently, economically, swiftly.

. . . .

Industrial Distributors provide the finest goods and services in the least possible time. Our files are sold exclusively through them.

Specify Nicholson and Black Diamond files

NICHOLSON U.S.A.

NICHOLSON FILE COMPANY, 27 ACORN STREET, PROVIDENCE, R. I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

BLACK DIAMOND U.S.A.

NICHOLSON and BLACK DIAMOND FILES

A FILE FOR EVERY PURPOSE

CIRCLE INFORM-A-GRAM KEY NO. 53

YOU GET MORE "CUTABILITY"

with . . .

NEWCOMER *Controlled Quality* CARBIDES

You can always rely on NEWCOMER performance . . .

FOR CUTTING STEEL				
Grade	Description	RECOMMENDED		
		Cut Depth	Feed	Speed (SFPM)
NS-15	Precision Finishing	.004" to .060"	.004" to .024"	250 to 850
NS-2	General Purpose	1/64" to 1/2"	.005" to .040"	150 to 525
NS-3 NS-4	Milling and Roughing	1/8" to 1"	.010" to .090"	100 to 500
NS-65	Heavy Roughing	1/16" to 1 1/2"	.020" to .125"	75 to 200

FOR CUTTING OTHER MATERIALS				
Grade	Description	RECOMMENDED		
		Cut Depth	Feed	Speed (SFPM)
NC-2	Precision Finishing	1/64" to 1/4"	.005" to .020"	200 to 1000
NC-3	General Purpose and Milling	1/16" to 3/4"	.010" to .040"	200 to 1000
NC-4	Roughing	1/8" to 1"	.020" to .093"	Moderate 80 to 1000
NC-5	Extra Heavy Roughing	1/8" to 1 1/4"	.040" to .125"	Slow 20 to 150

FOR HIGH VELOCITY MACHINING				
Grade	Description	RECOMMENDED		
		Cut Depth	Feed	Speed (SFPM)
NewMet NM-95	Not a ceramic nor a tungsten carbide, but an all new METALLIC CUTTING MATERIAL for cutting steel and other materials	.001" to 1/4"	.001" to .015"	to 1500

In today's production picture, profitable metal removal calls for tooling efficiency that pares machining costs "to the bone." Made with a consistent, reliable, high hardness-toughness ratio from lot to lot, Newcomer Controlled Quality Carbides are designed to take their place in your production picture and give you more "CUTABILITY."

With Newcomer Carbides, "CUTABILITY" means faster speeds and feeds . . . heavier cuts . . . exceptional resistance to interrupted cut impacts . . . and a wear resistance that gives you "extra mileage" on every production run.

For reliable and consistent metal cutting . . . specify NEWCOMER *Controlled Quality* CARBIDES!

For high velocity machining . . . it's NewMet by NEWCOMER

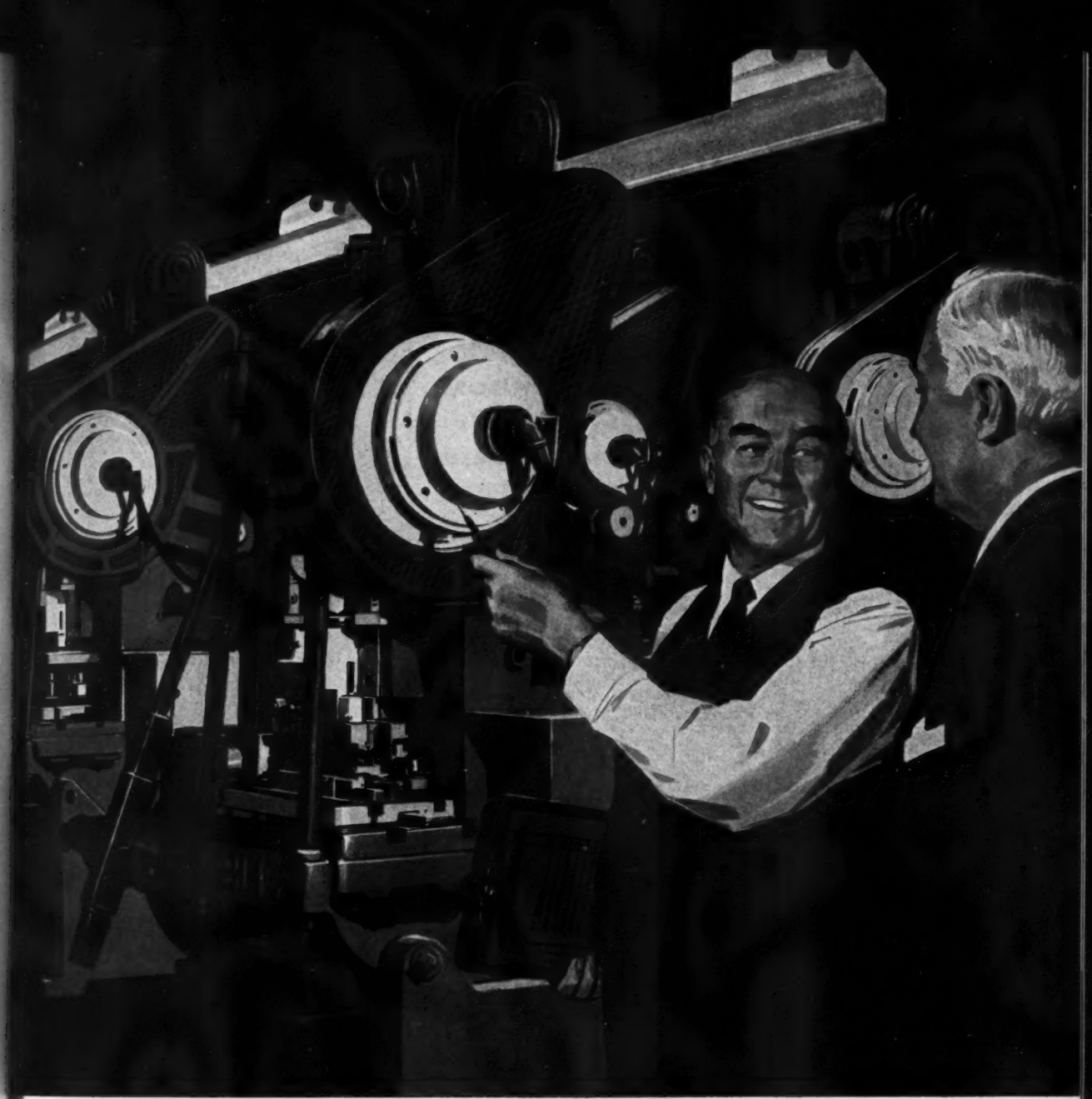
NEWCOMER PRODUCTS, Inc.

LATROBE, PA.

General Sales Office: 512 Franklin Ave., Pittsburgh 21, Pa.

Sales Offices Located in Principal Cities

CIRCLE INFORM-A-GRAM KEY NO. 54



"These 'super-speed' inclinables give me twice the production . . . at about half the cost!"

From their special vibration-absorbing legs to their counterbalanced shafts, these presses are built for speed.

With such special features as bronze gibs . . . automatic lube systems . . . special clutches, brakes and flywheels, and equipped with precision feeds, they can knock out short stroke work at better than 500 strokes a minute! They're all new, all Bliss, and the cost is low—surprisingly so.

These are the latest members of Bliss' line—the line that offers industry its most complete choice of types and sizes. And with no axe to grind for any one type, you can be sure of impartial pressroom counsel—by Bliss.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

CIRCLE INFORM-A-GRAM KEY NO. 55

GET GORTON *and you* GET ALL THIS . . .

TOOL ROOM *accuracy* **with**

HEAVY DUTY PERFORMANCE
. . . resulting in immediate economy!

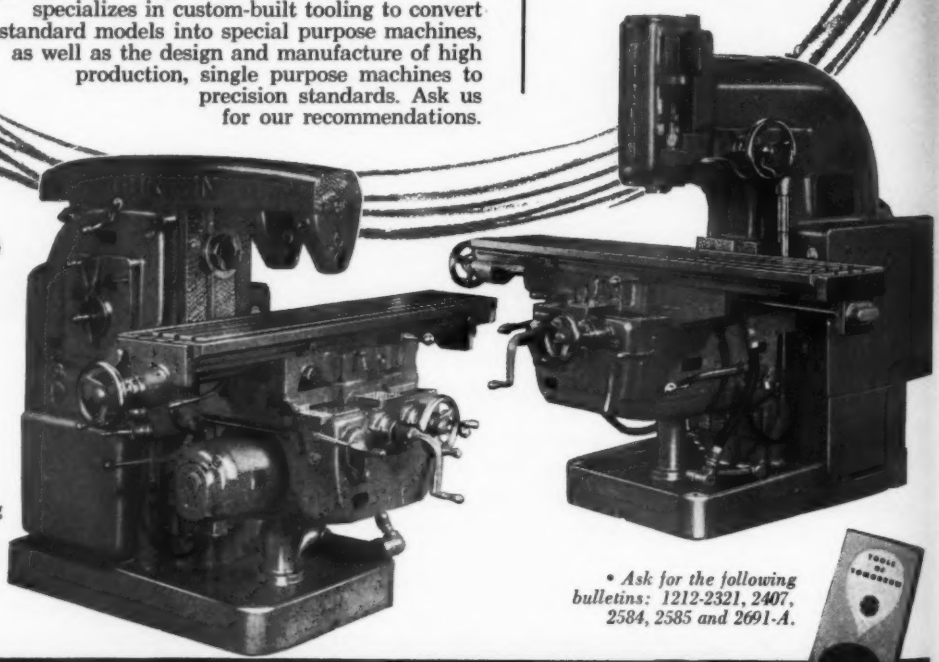
Features you should demand . . . Square lock bearing guides with long length-to-width ratio between column and knee and knee and saddle; spindle motor drives spindle only with separate feed motor; designed for high-speed steel or carbide milling, either conventional or climb milling; dial-type horsepower load meter for spindle; interchangeable assembly unit construction; 100% mechanical and electrical overload protection for gears, cutter and work; removable coolant pan for easy clean-out and quick coolant change; unique spindle bearing cooling system — heat is dissipated and dispersed throughout column. Gorton *verticals* are also available for aircraft work with high cycle spindles and rapid table feeds; *horizontal models* can be had with super-speed vertical spindle head and ram assemblies. For high production, specify Gorton automatic cycling.

Special tooling and machines . . . Gorton specializes in custom-built tooling to convert standard models into special purpose machines, as well as the design and manufacture of high production, single purpose machines to precision standards. Ask us for our recommendations.

More usable power at the Spindle than in any comparable machine, due to superior gear train design.

PROOF **. . . check your stock removal against horse power consumed . . . a real test for any milling machine.**

When you buy "Horse power," be sure it is *usable* horse power.



89

COMBINATIONS

Plain-Type Mills
Universal Mills
Vertical Mills
56" Tables
62" Tables
76" Tables
28" Table Travel
34" Table Travel
48" Table Travel
7½ to 25 H. P.
Speed Ranges according to requirements
Feed Ranges according to requirements

• *Ask for the following bulletins: 1212-2321, 2407, 2584, 2585 and 2691-A.*

GORTON

GEORGE *GORTON* MACHINE CO.

1212 RACINE ST., RACINE, WISCONSIN

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

Bellows Air Motors help make the "Inchworm" inch . . .

The makers of the INCHWORM®, that fantastic mechanism that can precision feed tools in the microinch range, faced what at first appeared to be an insurmountable problem: How to develop 2500 psi oil pressure and maintain it precisely for controlled time periods.

Airborne Instruments Laboratories, Mineola, L. I., makers of the INCHWORM, called in a Bellows Field Engineer. "What can we do with 'controlled-air-power'?" they asked.

Airborne and Hydrair Corp. (Bellows engineering division) jointly devised a unique closed-circuit air-hydraulic unit which takes 50 psi air pressure, builds it to 2500 psi oil pressure, and holds it precisely at that point for a predetermined time period. They made the INCHWORM inch—a movement controllable in the range of 0.000,005" to 0.0001".

This application of Bellows "Controlled-Air-Power" is unusual, yes, but no more so than the many special problems Hydrair Corp. engineers are solving every day in fluid power use.

If you have a special control problem involving the use of pneumatic or hydraulic circuits, talk to a Bellows Field Engineer. You'll find it well worth while.

®Airborne Instruments Laboratories

952-B

They're in the book

One or more Bellows Field Engineers are located in every major city or industrial area in the United States and Canada. They are listed in their local phone directories under "The Bellows Co." (In Canada, under Bellows Pneumatic Devices of Canada, Ltd.) Phone him, or write for a copy of our booklet—"The Place of the Bellows Air Motor in Original Equipment Design." Address Dept. TP1257.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 57

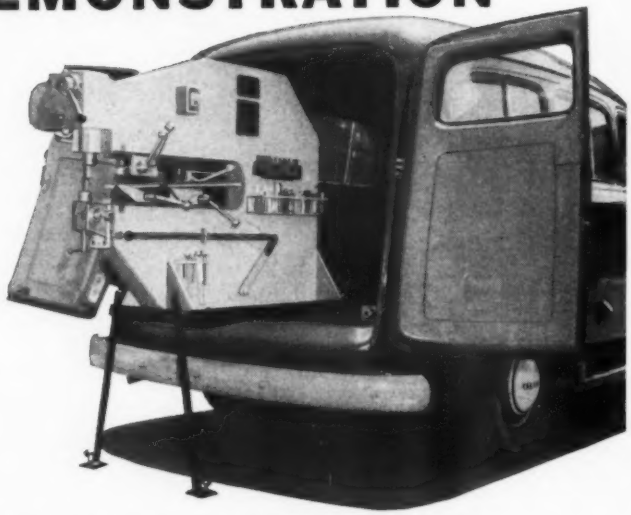
HERE COMES PULLMAX

NOW WE'LL BRING A

PULLMAX MACHINE

RIGHT TO YOUR PLANT FOR A

DEMONSTRATION

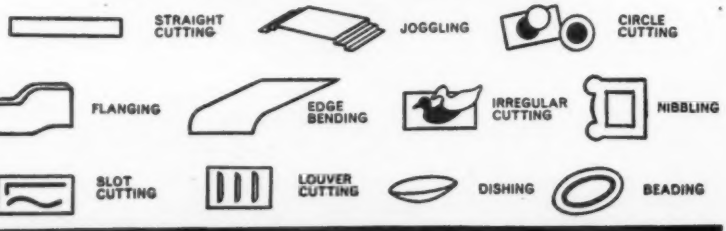


We've found that you just can't believe the amazing versatility of the Pullmax Machine until you've seen it in operation. Now, all Pullmax Sales Engineers are equipped with a station wagon carrying a Pullmax machine. He's ready to come to your plant (by appointment) and demonstrate to you and others, this "Complete sheet metal shop in one Machine". You owe it to yourself to see this revolutionary machine.

Just write and tell us when you would like to see the Pullmax demonstrated at your plant.

Catalog Upon Request

ONE PULLMAX DOES ALL THIS



AMERICAN PULLMAX CO., INC.

2469 NORTH SHEFFIELD AVENUE, CHICAGO 14, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 58

Talk of the Month

Management's Challenge to Production and Inventory Control

by Hugh D. Luke

Vice President — Operations Group

THE RELIANCE ELECTRIC & ENGINEERING CO.

Cleveland, Ohio

THE DEGREE TO WHICH MANAGEMENT approaches a sound practical solution to the dual problem of Production Planning and Inventory Control determines, in large part, the degree of success which a company will have in meeting planned over-all objectives and goals.

No. 1 — Customer Satisfaction

The long term success of any company depends upon satisfied customers, and, while there are many items that affect customer satisfaction, they all add up to good service. There are three things for which Production and Inventory Control people are responsible that contribute significantly to good service.

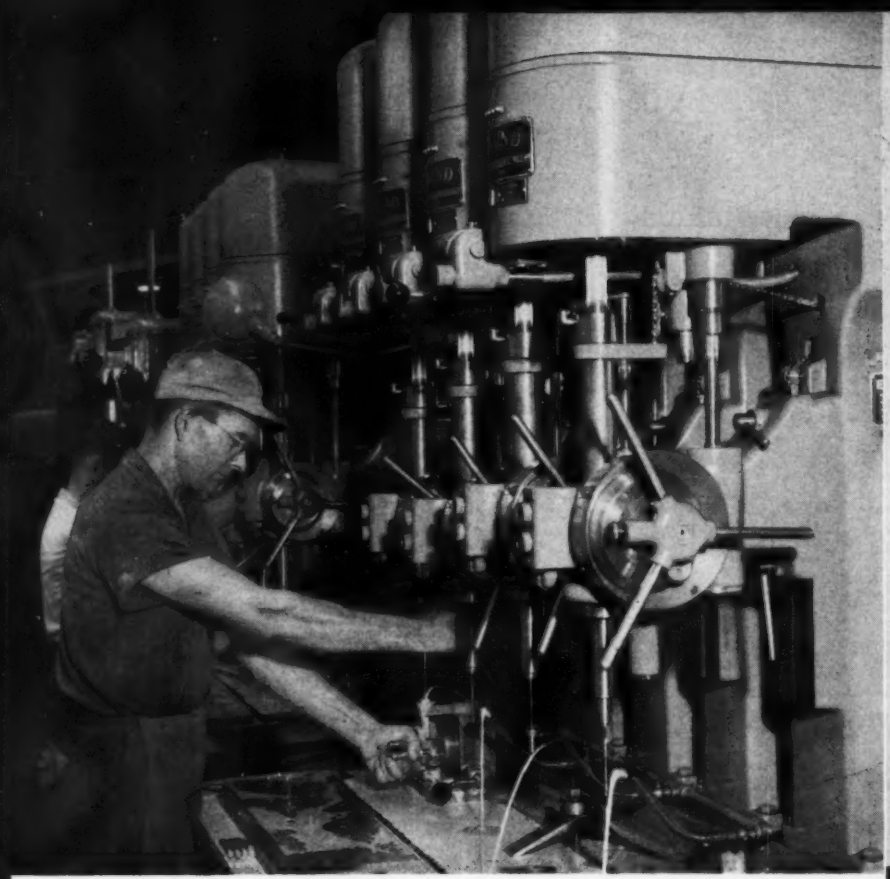
First, *customers want a reliable promise as to when we are going to deliver*. They want the items they have ordered when they have been promised and they don't want excuses.

Sure, they will change their minds and tell us to change quantity or change specifications. We may have to redesign, buy more material, break into setups, work overtime, and generally break our backs. But, the

. . . Continued on page 60

Adapted from Mr. Luke's talk at the Charter Meeting of the newly-organized American Production & Inventory Control Society, last month in Cleveland.

CATERPILLAR



IMPROVED QUALITY

GREATER ECONOMY

INCREASED EFFICIENCY

Edlund 2F Drilling and Tapping machines in Caterpillar's Peoria Plant.

Dependable, rugged Edlund Drilling and Tapping machines meet the challenge of Caterpillar's exacting demands for better methods of manufacture. For drilling, reaming, chamfering operations these power-packed Edlund machines furnish constant, trouble-free service, reduce "down-time" to a minimum and require only routine maintenance.

Also Model 1F with infinite speeds to 10,000 rpm and
⅜" capacity.
Write for Bulletin 160.

And Model 4F with infinite speeds to 2200 rpm and
1¼" capacity.
Write for Bulletin 170R.

Model 2F Features: **Top production machine for medium to heavy drilling and tapping. Infinitely variable speeds to 3600 rpm**
8" - 12" - 15" Overhang
1¼" Capacity
Write for Bulletin 140R

EDLUND REPRESENTATIVES IN MAJOR CITIES

EDLUND
MACHINERY COMPANY
Cortland, New York
Division of Harsco Corporation

"Nous Sommes Ici!"

When you need it NOW call Wheelock-Lovejoy!
—for Alloy Steel bars, billets, forgings

Some jobs won't wait for red tape. When you want steel *in a hurry*—just pick up the phone and call your nearest Wheelock, Lovejoy warehouse.

Expert W-L metallurgists will help you choose the right stock for the job.

Write our Cambridge office today for your *free* Wheelock, Lovejoy Data Sheets. They'll give you complete technical information on grades, applications, physical properties, tests, heat treating, etc.

Warehouse Service—Cambridge • Cleveland • Chicago Hillside, N. J. • Detroit • Buffalo • Cincinnati • *In Canada*—Sanderson-Newbould, Ltd., Montreal & Toronto.

WHEELOCK, LOVEJOY & COMPANY, INC.
135 Sidney Street, Cambridge 39, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 60

. . . Month's Talk from page 58

customer is not the least bit sympathetic. He still wants his order on the date promised.

So, we turn handsprings and deliver according to promise. The result is a satisfied customer who is likely to stick by us for a long time. This is a big step toward establishing a sound basis for long term growth of any firm.

The second item of importance to good customer relationship for which you are responsible, is *keeping him advised when delivery cannot be made on time.* I don't mean that you make a re-promise each time a machine breaks down, a key man is absent, or any one of a number of things happen to upset your plans. You certainly must know when these things happen and exert every influence you have to get corrective action that will maintain "on time" delivery. When it is obvious that all efforts will fail in this regard, the customer must be told at once. Your information should be timely and accurate enough to do this before the day of shipment. At the same time, he must be given a re-promise that will be met.

Some years ago, I was involved in sampling customer opinion for a company that wanted to know what area affecting customer satisfaction most seriously handicapped their growth possibilities.

The pattern of the survey was quite clear. On the plus side, the company salesmen were rated tops. The design engineering ability was rated among the best. The performance of the product was as good as, if not the best, in the industry. On the negative side, we heard remarks by the customer such as "You never know when you are going to get shipment," or "If they would only tell us when they are going to be late and then keep their word on the re-promise."

That particular company actually had suspected this situation. Now it was confirmed. The half-hearted attempts previously being made were turned into dynamic corrective action.

Thirdly, and finally, *customers want short cycle rush orders once in awhile.* Just as you find yourselves in a hole occasionally and need special service from your vendors, so your customers expect the same thing. The real problem, obviously, is if you take too many rush orders you find you are satisfying a few customers at the expense of others.

. . . *Continued on page 62*

ACCURACY WITHIN 5 THOUSANDTHS OF AN INCH . . . OVER 14,400 SQUARE INCHES!

An example of a precision surface need met by CHALLENGE EQUIPMENT.

The American Seating Company of Grand Rapids, Michigan, needed a precision surface 50 feet in length, accurate within 5 thousandths of an inch over the entire area, on which to inspect the aircraft wing spars and aluminum castings they are producing for a large aircraft manufacturer.

The answer was easy! Challenge supplied five of their standard Sectional Assembly Layout Surface Plates each 10 feet in length. When keyed and bolted together, these "exclusive" Challenge units, each accurate within .002", provide an overall accuracy of .005 of an inch. Another advantage for American Seating is the flexibility of these units! If the production needs change, the sections can be taken apart and used separately, or new sections can be added as needed.

This is just one example of how Challenge has helped many manufacturers solve their precision surface requirements. Challenge has the broadest line of precision surface equipment and Challenge factory specialists are available to work with you on your needs. So, if you have an inspection, assembly or manufacturing problem involving precision surfaces, **check first with Challenge.**

Write Challenge,
for a complete Catalog of Challenge Standard Precision Surface Equipment — including Semi-Steel and Granite Surface Plates, Semi-Steel V-Blocks, Angle Plates, Floor Plates, etc....

Available through local mill supply distributors.

TP-12

Challenge®

THE CHALLENGE MACHINERY COMPANY
GRAND HAVEN, MICHIGAN

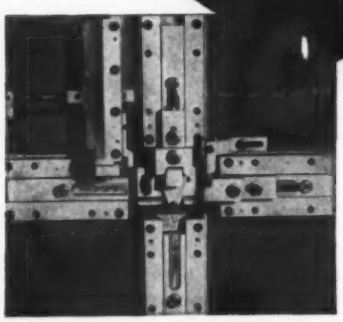
Please send me your free catalog — 838W
of Challenge Precision Surface Equipment.

Name_____ Position
Company_____
Address_____
City_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 61

NEWEST

CONCEPT IN FORMING



NILSON VERTIFORM

Our LATEST DEVELOPMENT— Applying 4-Slide Forming Techniques To A Vertical Machine.

Designed For Rapid Tooling Set-Up And Ease Of Operation.

MACHINE SPECIFICATIONS #V-187

- Max. diam. wire—inches ..... .187
- Max. length of feed—standard 15"
- Max. length of feed—with change gears ..... 30"
- Max. width ribbon metal ..... 1¼"
- Stroke of forming slides ..... 2½"
- HP. required 2
- Machine speed—standard 30-120 RPM
- 4 and 20 ton Press Attachments available.

ADVANTAGES OF THE NILSON VERTIFORM

1. Greater Tool Accessibility
2. Unobstructed View Of Product Being Formed
3. Forming Slide Units Removable and Interchangeable
4. Less Floor Space Required
5. Operator Safety (Most Moving Parts Enclosed)
6. Automatic Oiling Of Entire Machine

Write To Our New Plant For VERTIFORM CATALOG

THE A. H. NILSON MACHINE CO. Bridgeport Ave., Shelton, Conn.

NILSON

CIRCLE INFORM-A-GRAM KEY NO. 62

. . . Month's Talk from page 60

Management expects you to plan the operation to accommodate a certain quantity of rush orders. There is no pat answer to this problem. Each of you must develop the best plan for your particular situation. I sincerely believe most top management people recognize the difficulty of this problem.

These three items by themselves do not represent the total requirement for a satisfied customer. I assure you, however, they do represent a significant segment of the total. They are items that Management challenges you to handle successfully as part of your responsibility.

No. 2 — Low Cost Products

Just as you are expected to make a significant contribution to customer satisfaction, so are you expected to make a contribution to the cost reduction programs of your company. Production Planning and Inventory Control has a definite effect on the three major cost items: direct labor, material, and overhead.

For example, the "unavoidable delay time" that adds to your direct labor cost can be reduced through better planning. A big factor in direct labor productivity is morale of the labor force as well as the supervisory force. It is an intangible and certainly difficult to evaluate, but I know from personal experience you get the best productivity only when everyone knows what he is to do next. When he does know what he is to do next, the morale is bound to be better.

From the standpoint of material costs, you know that the right material, in the right quantity on hand, when needed, avoids the high cost of improvising in the shop. Placing orders for economic lot quantity purchases to give lowest practical material costs for your particular company is a familiar tune which you have heard many times.

Reduced overhead costs can be achieved by replacing the stock chasing, expediting, fire fighting method of production control with sound, effective planning. The number of expediters and stock chasers, and the amount of time spent by Foremen on such items are good barometers of the effectiveness of your planning. Reduced to a minimum, they mean lower overhead.

Management challenges you to investigate, analyze, and take action in these areas in a manner that results in cost reduction, not as a one shot proposition, but on a continuous

. . . *Continued on page 64*

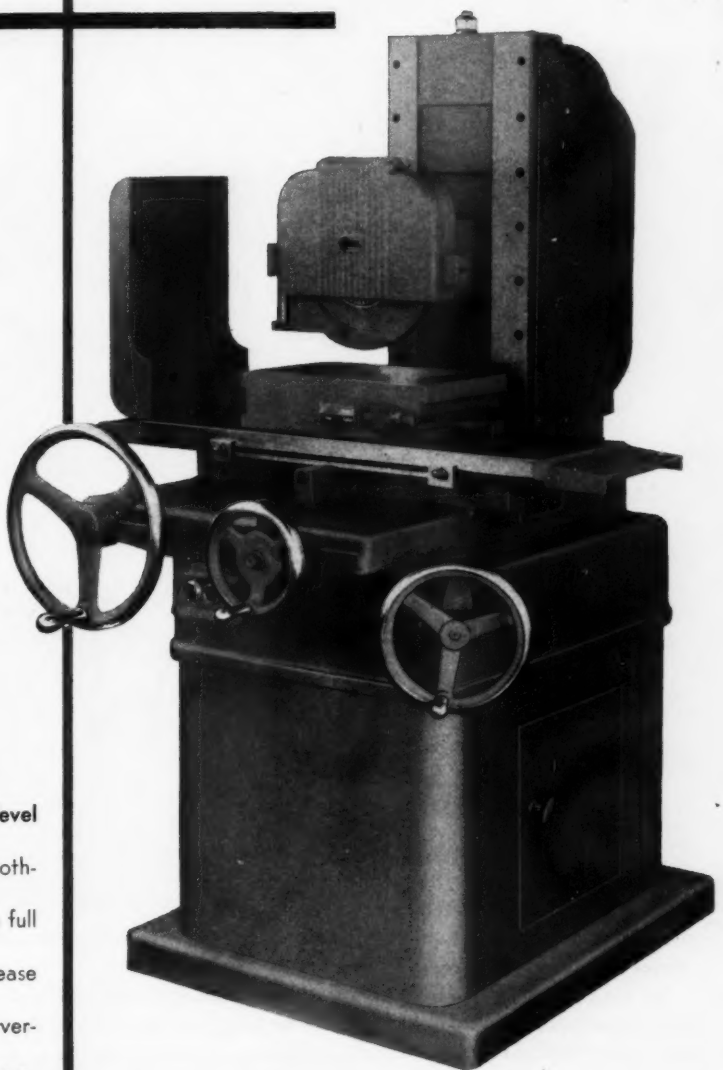
NEW

Surface grinder gives you LARGE CAPACITY at LOW cost...

COVEL No. 17

10" x 16" HAND FEED

Set-up time and operator effort are reduced while accuracy is increased by the advanced Covel design features incorporated in this new surface grinder. You can handle die block and general tool room work with remarkable efficiency and speed with the new Covel No. 17 which gives large capacity at low cost.



Note these advanced Covel features:

- **Elevating handwheel** is **below table level** for extra convenience.
- **Timing belt drive** actuates table for smoother grind.
- **Large diameter handwheel** moves table full 16" with only 2¾ turns.
- **Precision ball-bearing spindle** is grease lubricated—sealed for life.
- **Hardened and ground lead screws** on vertical and transverse feeds.

WET ATTACHMENT AVAILABLE

- **Hard chrome table ways** can be furnished to eliminate need for periodic re-scraping.

Work Capacity	Grinding Wheel	Spindle Motor	Spindle Speed
10" x 16" x 14"	12" x ¾" x 3"	2 H. P.	1750 RPM

- ***Learn all the facts about the Covel No. 17. Ask for Bulletin 17TP12.***

Covel Offers the Widest Choice in Surface Grinders up to 14" x 24" • Cutter and Tool Grinders • Drill Grinders • Optical Comparators.

COVEL PRECISION GRINDERS

BENTON HARBOR, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 63

See how big 3-D views speed assembly, measurement and inspection of tiny parts.

FREE

15-DAY, ON-THE-JOB

TRIAL!

These essential production tools make small-parts manufacture faster and easier, make precision surer. Views are vivid, magnified in natural 3-dimensional detail. Complete line to fit exact model to your specific industrial needs. Dustproof, shockproof, built for rugged production-line use —you can mount them right on machines!

See for yourself! Use a B&L Stereomicroscope on your own job for 15 days—absolutely free, no obligation. All we ask is the opportunity to let our Stereomicroscopes prove themselves to you. Just call your regular B&L dealer, or mail the coupon today.

BAUSCH & LOMB OPTICAL CO.
77324 ST. PAUL ST., ROCHESTER 2, N. Y.

☐ Yes, I'd like to borrow a B&L Stereomicroscope for a 15-day trial without cost or obligation.

☐ Send me B&L 3-D Micro-Vision Book, containing valuable data, showing actual stereo views.

NAME.....
TITLE.....
COMPANY.....
ADDRESS.....
CITY..... ZONE..... STATE.....

BAUSCH & LOMB
SINCE 1853

CIRCLE INFORM-A-GRAM KEY NO. 64

. . . Month's Talk from page 62

basis, thus helping your company produce its products at the lowest possible cost.

No. 3 — Maximum Return on Investment

Another item of major importance to Management of successful companies is return on investment. As you know, this includes money invested in land, buildings, machinery equipment, and inventory.

You might feel you are responsible only for inventory size. Let's examine the facts. Suppose you are in the steel industry. It costs $300.00 to build capacity for producing one extra ingot ton per year. Thus, if by proper production planning and control you make it possible to produce one extra ton per day, you can save a plant and equipment investment of some $100,000.00. Regardless of the business, better planning and control increases utilization of facilities and return on investment.

An adequate, but not excessive, inventory keeps to minimum the capital required for warehousing facilities, reduces losses due to obsolescence, and minimizes the cost of money tied up in inventory. Most of us have an arbitrary ratio of turnover by which we justify our inventory. We must not overlook the impact the inventory dollars have on return on investment.

These are three major challenges of Management. For most of you, they are outlined in your job descriptions, and studied and discussed in your Management meetings. You can generally establish clear cut bench marks from which you can measure or be measured in regard to performance.

There are other challenges, however, of a more general nature that apply to all Managers and therefore apply to you.

No. 4 — Create Teamwork

A Manager is not necessarily appointed to his position on the basis of demonstrated administrative skill. There is no question, however, that the degree of success which he attains will depend on the skill with which he administers. Determination of clear cut objectives or goals is not sufficient. The proper organization will enable a Manager to do his job. But, it is the spirit of the organization that really determines whether the job will be done successfully. This example should explain what I mean by spirit of the organization:

. . . *Continued on page 66*

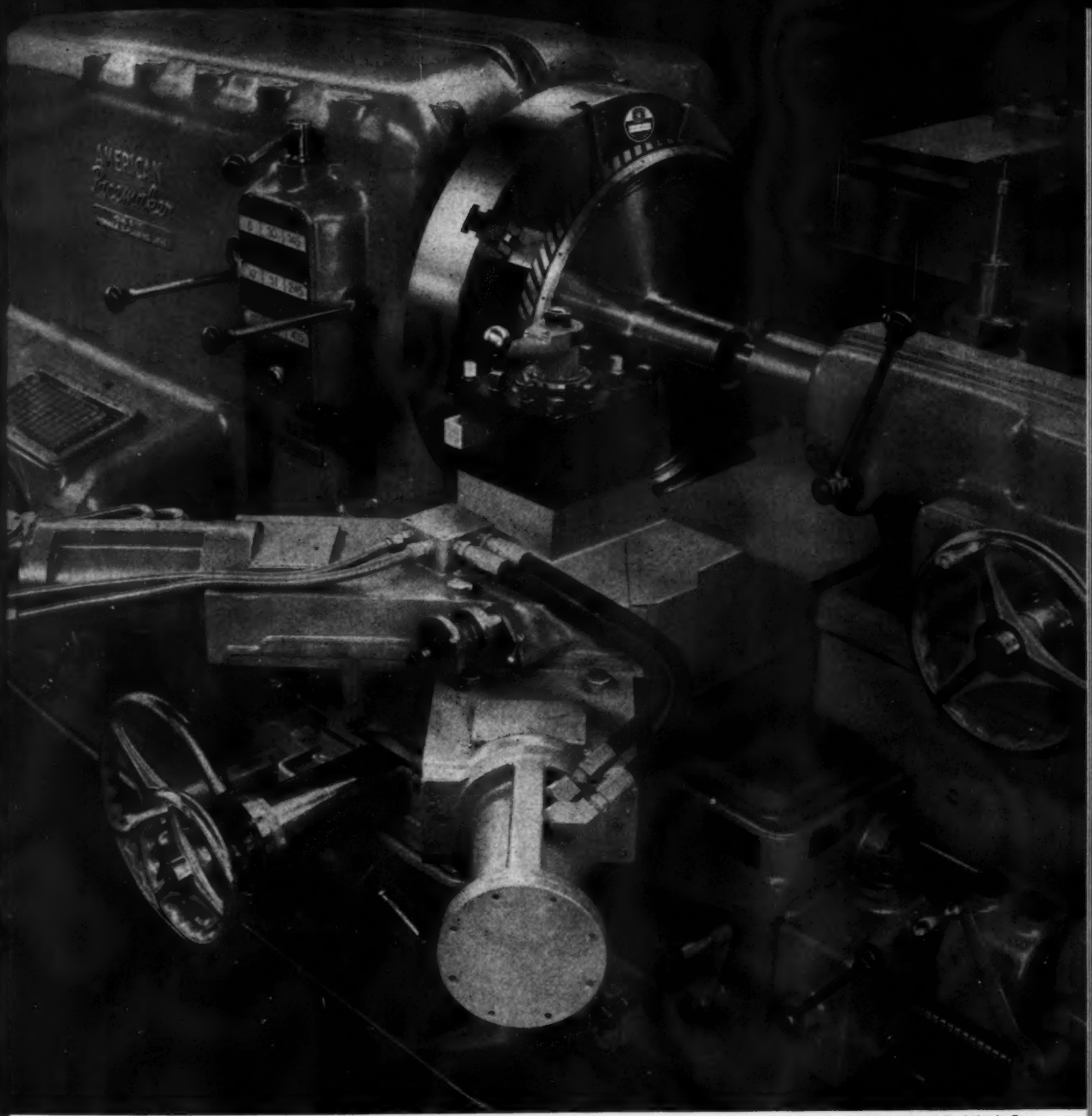


Photo courtesy of The American Tool Works Company

THE LATHE — *American Pacemaker 25" Style "G" Hydraulic Duplicating Lathe*

THE OPERATION — *Machining a jet engine compressor wheel*

THE CHUCK — *Horton, of course*

HORTON Since 1851 CHUCK

HORTON CHUCK DIVISION

Greenfield Tap and Die Corporation

Windsor Locks, Connecticut

Call Your Horton Distributor Now!

PRECISION PRODUCTION PROBLEMS?

Here's help from Bausch & Lomb in TOOL DESIGN INSPECTION FABRICATION MEASURING TESTING

NEW! ALIGNMENT INTERFEROMETER

Accurately measures small changes in angle over a range of 30 seconds of arc (±15 seconds). Easy direct scale readings to 0.2 seconds (0.000006″).

BENCH COMPARATOR

Exclusive understage illumination—no complex set-ups, no holding fixtures for most work. Magnified silhouettes show errors instantly. Reads to 0.0001″ with optional micrometer stage.

STEREO-MICROSCOPES

Magnified 3-D views of tiny parts. Dustproof, shockproof, can be mounted right in machine or fixture. Speeds assembly, inspection. Most complete line, widest field of view.

CONTOUR MEASURING PROJECTOR

Shows magnified silhouettes or surface views. Simple operation, highest precision measurements: to 0.0001″, linear; to 1 minute of arc, angular.

OPTICAL AIDS CATALOG

Time-and-money-saving data on Surface Comparators, Industrial Magnifiers, Macroscopes, Microscope Bodies, Micrometer Discs, Wide Field Tubes, Brinell Microscopes, Shop Microscopes.

NEW TOOLMAKER'S MEASURING MICROSCOPE

Quickly measures opaque or transparent objects of any contour. Linear, accurate to 0.0001″; angular, to 1 minute of arc.

MAIL COUPON TODAY FOR VALUABLE DATA

BAUSCH & LOMB OPTICAL CO.
79824 St. Paul St., Rochester 2, N. Y.

Please send literature on optical production aids checked below:

☐ Alignment Interferometer ☐ Bench Comparator ☐ Contour Measuring Projector ☐ Toolmaker's Microscope ☐ Stereomicroscopes ☐ Optical Aids Catalog

NAME .....
TITLE .....
COMPANY .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

BAUSCH & LOMB
SINCE 1853

CIRCLE INFORM-A-GRAM KEY NO. 66

. . . Month's Talk from page 64

Several years ago, I knew a Production Control Manager who appeared to have all the talents necessary for success in this field. He could define objectives; he had excellent technical skills; he knew the product from A to Z; he could develop new techniques and procedures; he had imagination and initiative. As I say, he seemed to have what it takes. Yet, we were always in a fire fighting chaotic condition of poor coordination.

After many weeks of studying all the angles that might affect the performance, it was decided as a last resort, to interview some of the Supervisors working for this Manager on the hope that they might shed some light on the problem. The answer was quickly apparent. The subordinates were following instructions to the letter. At no time did they offer objections or make changes that were obviously needed. It was an atmosphere of do just what you are told — no more. There was no spirit in his organization, no teamwork.

The Manager's replacement was able to restore order in a matter of months and the displaced Manager was assigned to a staff position in another area of the company where he proved very successful.

No. 5 — Develop New Managers

Finally, there is the challenge to you Managers downward to your Supervisors and subordinates. It is the subject generally referred to as development of people.

It is true that you, in the true sense, cannot develop anyone . . . you must provide assistance. You must make sure first that your subordinates know and understand what is demanded of them. You must help them define their objectives and then help them reach those objectives. You must make sure they are getting the necessary tools and needed information. You must advise and counsel regularly. You must, in effect, teach them to do better and encourage them to give their best at all times.

In doing these things well, you are demonstrating leadership. I don't mean the magnetic personality type who makes friends and influences people — that is salesmanship. I mean the type of leadership whereby you lift a man's vision to higher levels, raise his performance to a higher standard, and build a personality beyond his normal limitations.

Successfully carrying out this part of your job means you are develop-

. . . Continued on page 68

Get the competitive edge for the years ahead...

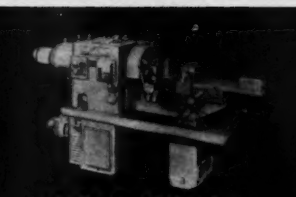
by planning a continuing modernization program

Look to the company that is constantly analyzing modern trends in metalworking to better fulfill the needs of industry by developing new types and sizes of machines—extending its Sales Engineering facilities to be of even greater service.

Look to your Warner & Swasey Field Engineer as your "turning specialist". He can help you select the right machine, and will continue to *share your interest* in its performance in the years ahead.

SADDLE TYPE TURRET LATHES

1-A UNIVERSAL EXTRA HEAVY DUTY
2½" or 3" Bar Capacity — 16¼" Swing
2-A UNIVERSAL EXTRA HEAVY DUTY
3½" or 4½" Bar Capacity — 20" Swing
3-A UNIVERSAL EXTRA HEAVY DUTY
4½" or 6" Bar Capacity — 23½" Swing
4-A UNIVERSAL EXTRA HEAVY DUTY
9" or 12" Bar Capacity — 28¼" Swing
5-A UNIVERSAL EXTRA HEAVY DUTY
12" Bar Capacity — 36" Swing

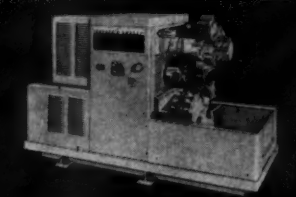


ELECTRO-CYCLES

No. 1 ELECTRO-CYCLE
⅞" Bar Capacity — 11" Swing
No. 3 ELECTRO-CYCLE
1½" Bar Capacity — 15⅜" Swing
16" ELECTRO-CYCLE
1½" Bar Capacity — 16⅞" Swing
® Reg. U.S. Pat. Off.

RAM TYPE TURRET LATHES

No. 2 ALL-GEARED HEAD
1" Bar Capacity — 14" Swing
No. 3 UNIVERSAL
1½" Bar Capacity — 15⅜" Swing
No. 4 UNIVERSAL
2" Bar Capacity — 18⅛" Swing
No. 5 UNIVERSAL
2½" or 4½" Bar Capacity — 20" Swing



SINGLE SPINDLE AUTOMATICS

1 AC CHUCKING MACHINE
8" or 10" Chuck — 6" Working Stroke
2 AC CHUCKING MACHINE
10" or 12" Chuck — 9" Working Stroke
3 AC CHUCKING MACHINE
15" Chuck — 11" Working Stroke

PRECISION TAPPING AND THREADING MACHINES

No. 10
TAPPING MACHINE
0-80 to 10-24 Capacity
No. 11
TAPPING MACHINE
8-36 to ⅞" Capacity
No. 11 RS
RADIAL (Single Head)
No. 11 RD
RADIAL (Double Head)
8-36 to ⅞" Capacity
No. 12 TAPPING MACHINE
⅜" to 2½" Capacity

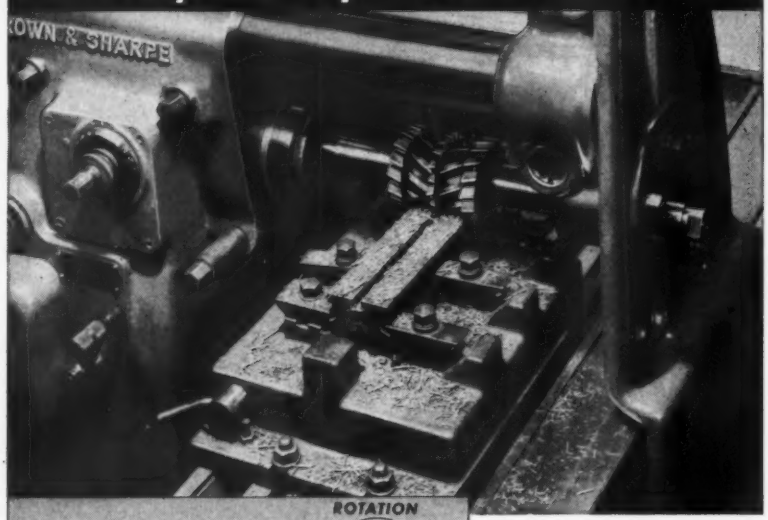
MULTI-SPINDLE AUTOMATICS

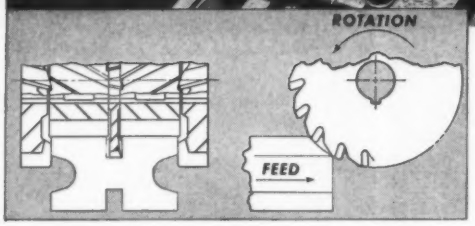
6-SPINDLE BAR MACHINE
1¼" Bar Capacity
5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity
5-SPINDLE CHUCKING MACHINE
6" Swing

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS... WITH A WARNER & SWASEY

Brown & Sharpe CHIPS Stock removal costs money!...Chips tell *how much*





In climb (down) milling, work is fed in direction of cutter rotation. Chip is thickest at initial engagement of tooth, reaches minimum thickness at point where tooth ends downward travel through workpiece.

Economical "Gang" Climb Milling with High Speed Steel Cutters

Smooth, continuous chips prove that these Brown & Sharpe plain milling cutters are "climb milling" with top efficiency. Climb milling is used where work piece is difficult to hold, and for greater cutter life when milling tough steels and alloys.

Climb milling should be done only with cutters having rigid, sharp teeth and precision ground cutting edges. Brown & Sharpe High Speed Steel Cutters are PRODUCTIONEERED for longer life at high speeds—no matter what type of milling is performed. Get the most out of your milling machines: Maximum speeds and feeds with less horsepower, less downtime. For real production economy, always specify Brown & Sharpe PRODUCTIONEERED Cutters!

Write for 80 page Brown & Sharpe Catalog showing over 2300 High Speed Steel Tools and Accessories.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

Brown & Sharpe

BROWN & SHARPE MFG. CO. • PROVIDENCE 1, RHODE ISLAND

STOCK OF OVER 3000 STANDARD TOOLS!
Obtain impartial High Speed Steel, Carbide and Carbide Tipped tooling recommendations from your Brown & Sharpe-NELCO Distributor.

. . . Month's Talk from page 66

ing Managers who can replace you, and at the same time you are developing the ability so necessary in the next step up in the organization where you will be managing a broader segment of the enterprise. No one develops as much as the man who is trying to help others develop themselves.

All of these and many more too numerous to mention here are challenges not from Management to you, but to you as members of the Management team.

As Peter Drucker says in his book "The Practice of Management", "We must not allow ourselves to forget that it is actually the specific situation of a Manager to have not one, but three, jobs at the same time, discharged by and through the same people, exercised in and through the same people. These three jobs are:

Managing a business,
Managing Managers, and,
Managing work and workers."

Management then does not challenge you to produce miracles rather, you are challenged to manage. In the true sense of the term, the best you know how at all times. Specifically, you must manage to:

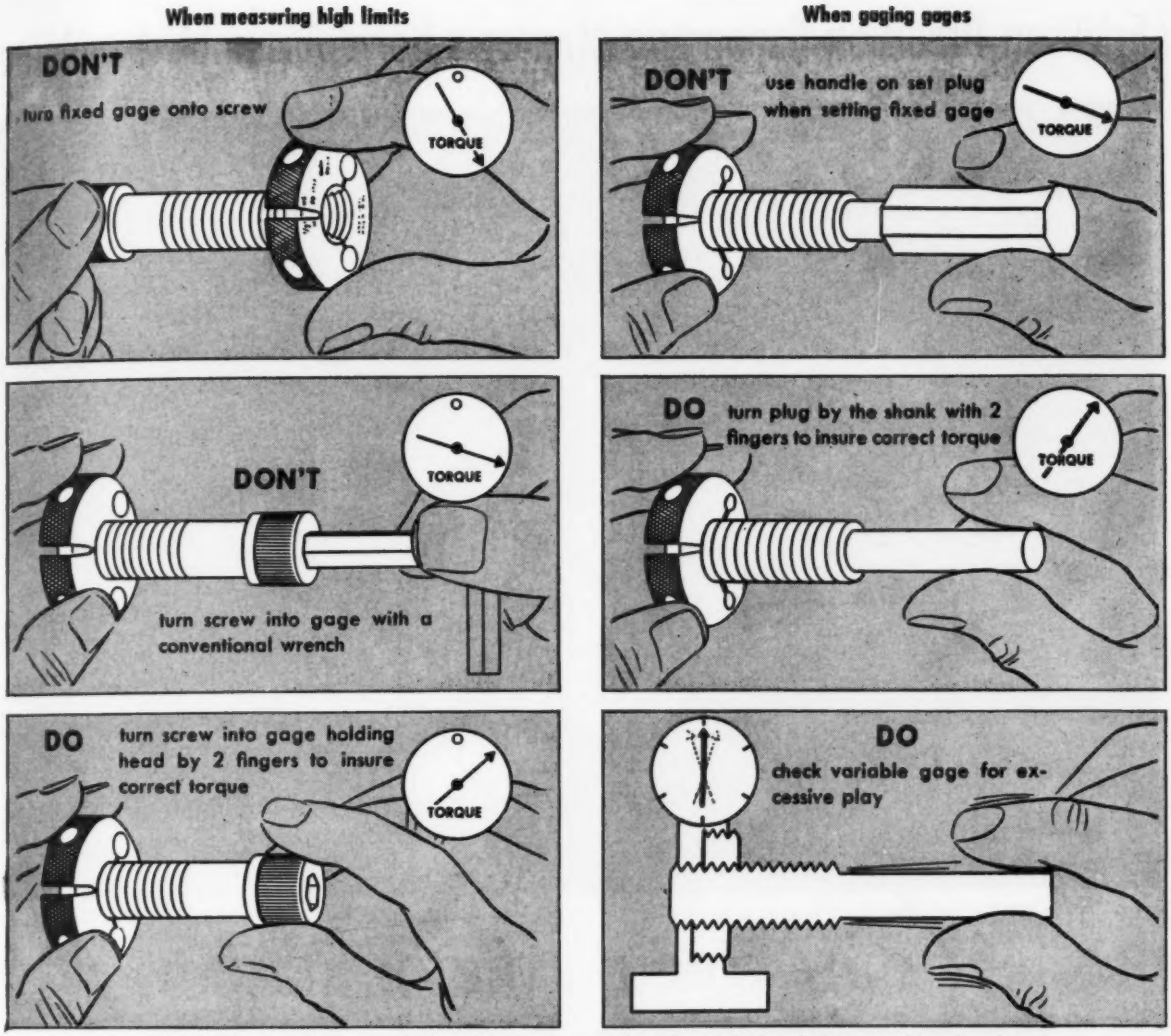
- create and maintain satisfied customers,
- produce at lowest practical cost,
- minimize the cost of investment,
- create a sound, spirited organization, and
- develop the Managers of tomorrow.

TECHNION OFFERS HI-TEMP CERAMIC TOOLING COURSES

As an aid to ceramic users in the electrical, electronic, instrument, aircraft, and automotive industries, the Duramic Division of Technion Design & Mfg. Co., Inc., is offering a number of one-day courses in high-temperature ceramic tooling methods.

Major topics to be studied include correct design of ceramic tooling, making low-cost cast ceramic tooling, machining ceramic tooling, and fastening ceramics. In addition, production engineers and manufacturing personnel taking the courses will be able to review specific problems with Technion engineers. The courses will be held on Tuesdays and Wednesdays in New York City, reports the company's spokesman, Herbert Schwartz.

CIRCLE INFORM-A-GRAM KEY NO. 68



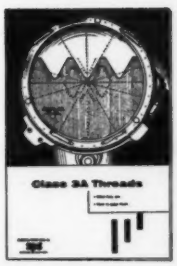
These illustrations from new SPS booklet show some of the do's and don'ts of gaging precision threads.

3A threads: what they are; how to gage them — new SPS booklet tells all

Threads made to Class 3A fit are the most precise in general use in industry. But you do not always get the 3A precision you specify. Because of many different gaging techniques that yield varying results, screws with threads well outside the Class 3A tolerance limits often pass inspection.

SPS has prepared a new booklet on this subject. It explains clearly what Class 3A threads are and the pros and cons involved in the widely varying gaging techniques in use today. It reviews the gaging of high and low limits of 3A threads, sampling techniques, and even the methods of gaging gages.

All standard UNBRAKO socket screw products fall within specified tolerance limits *no matter what method is used to gage them.* Leading industrial distributors carry complete stocks. Unbrako Socket Screw Division, STANDARD PRESSED STEEL Co., Jenkintown 36, Pa.



We also manufacture precision titanium fasteners. **Write for free booklet.**

Form 2239, "Class 3A Threads: what they are; how to gage them." 16 pages, with many illustrations. Write for free copy today.

STANDARD PRESSED STEEL CO.

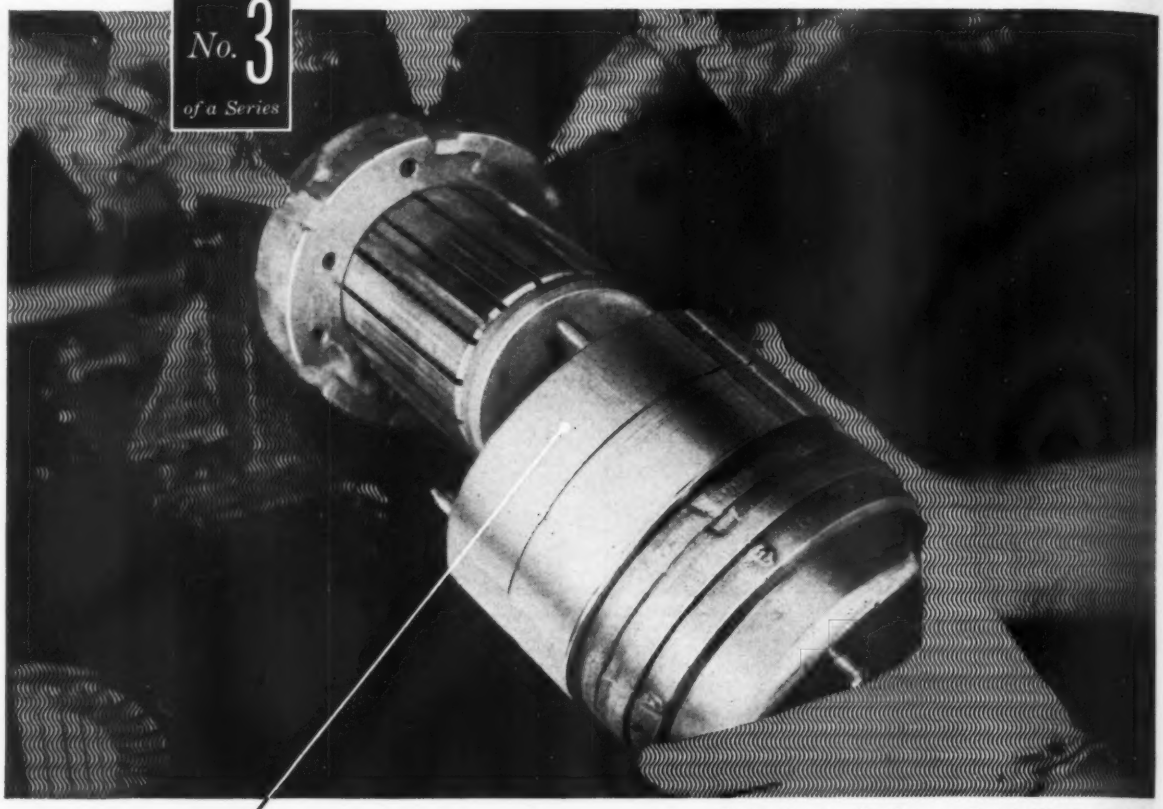
UNBRAKO® **SOCKET SCREW DIVISION** SPS

JENKINTOWN ■ PENNSYLVANIA

CIRCLE INFORM-A-GRAM KEY NO. 69

Erickson Precision Expanding Mandrels Solve Assembly Problems

No. 3 of a Series



Photos: Courtesy The Emerson Electric Mfg. Co., St. Louis

e.g. electric motor stators

Emerson Electric, big-name electrical manufacturer, assembles stator laminations the modern way—with Erickson Mandrels. Gone are the old-fashioned arbor assembly methods that require a large tolerance between laminations and arbor . . . that lead to eccentricity of stator bore and to additional finishing operations on the OD.

Emerson Electric works "from the inside out" with Erickson Precision Expanding Mandrels. Laminations are placed on a fixture and the fixture slipped over the expanding mandrel. Laminations are then welded together with two passes through a three-torch head.

Result? Stators are concentric within Erickson's guaranteed accuracy of five "tenths." And Emerson Electric gets a better motor with uniform air gap . . . that produces uniform torque and rated horsepower . . . that creates minimum electrical interference . . . and that lasts longer.

If this cost-cutting case history triggers your imagination, contact the nearest Erickson representative. He'll be pleased to demonstrate how Erickson Precision Expanding Mandrels can cut your assembly costs.

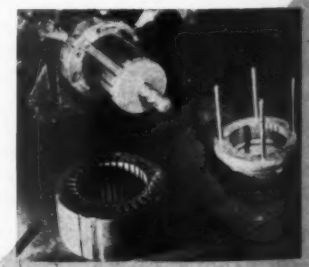
AA-4133

Collet Chucks
Floating Holders
Tap Chucks
Indexers

ERICKSON TOOL COMPANY

34351-12 Solon Road • Solon, Ohio

Tap Holders
Air-Operated Chucks
Expanding Collets
Special Holding Fixtures



ID of stator assembly (lower left) requires no finishing operation after welding.

Bothered by a tough holding problem? Then let us show you how Erickson mandrels speed production, lower grinding or inspection costs. Write for Catalog K.

The Crystal Comes Full Circle

IF THIS EDITOR would admit his advanced years he might say, "Transistors? Semi-Conductors? Crystal Diodes? What's new with them? As recently as 1912 I had a pocketful of them for everyday use in my wireless telegraph outfit!"

That's like some real oldtimer saying, "What's new about the horseless carriage? I drove my first one in 1901!"

There is, however, one big difference between the two implications. Since its advent, the horseless carriage has constantly been with us — advancing in technology and growing in numbers. But the crystal — transistor or semi-conductor or rectifier — came along for only a brief fling at glory and then faded away into the oblivion of obsolescence.

And, unwittingly, you (as well as I) probably played a part in banishing the crystal for close on to thirty years!

How come? It was all in the American tradition, as old as the country and as new as tomorrow. You simply refused to be satisfied with your standard of living (or listening)!

Back in the winter of 1920-21 you first heard music by wireless telephone from Pittsburgh's KDKA — remember? An aerial strung from your rooftop to a handy tree or telephone pole, a tuning coil, a crystal detector, and a pair of headphones did it.

Remember when you used to argue all noon-hour over which was the best crystal to use under the "cat's whisker" of your detector? — Silicon? — Galena? — Carborundum? Well, those very objects of your affections were the direct forebears of today's miniaturized electronics — hearing aids, pocket radios, missile guidance systems — and destined for tomorrow's anti-sputnik sputniks.

But "way back when," however, you insisted on more and better and louder "wireless." You wanted to fill a whole room with music from distant stations via loudspeaker instead of being captive to a pair of headphones. So you switched loyalty from your favorite crystal and swore allegiance to the "audion bulb" detector (suspected by Edison, valved by Fleming, and three-elemented by De Forest) with its several pounds of A, B, and C batteries.

With that, the vacuum tube was "in" — and embarked on a long and marvelous career, far from ended. And when you tossed your old crystal set down the basement stairs those first crystal rectifiers or diodes went into a state of suspended animation and back to the research laboratory.

Now, some billions of vacuum tubes later, the crystal has completed its circle. The researchers and developers have handed us a whole new crystal family of electronic wonders, of proved performance and reliability, of almost unbelievably long life, and of such low cost as to impose no economic barrier to their use.

It has, of course, taken a bit of doing by the R & D people. All the resources of the physicist, metallurgist, chemical engineer and mechanical engineer, were brought to bear on problems that were intensified, seemingly beyond all reason, by the diminutive scale of the product.

We are talking about the production and assembly of a crystal to which is secured two or three terminal wires and protectively encased in an insulating shell of match-head-size.

As if this weren't enough, the crystals have to be produced to a degree of chemical purity originally claimed impossible. To produce silicon having one part impurity to 100 billion parts silicon is a quality control project that separates the men from the boys. Surely it would be much easier to find the one black marble in a box of white marbles — said box being the size of the Pentagon!

Mechanically, one end result is that transistors now come packaged in belts and are machine-gunned into electronic printed circuit boards and modules. Rugged, what?

Chronologically, consider this: the first transistor was developed less than ten years ago. Today, it is a widely accepted and vital component of military and civilian electronics — an accomplishment equivalent to a 25-year span devoted to any other technical improvement in industry.

The economics side of the picture, as painted by free enterprise, competition (there are forty producers of "solid state" electronics), and manufacturing techniques is equally fabulous in the American fashion:

A germanium diode used in great volume in computers, which sold for $5 four years ago now sells in quantity for 70 cents; a silicon diode (instrumentation, telemetering, and data processing) cost $6 two years ago, now carries a price tag of $1.25; and a silicon power rectifier of wide application can be had for $3 vs $7 eighteen months back!

What are the prospects for this "infant" industry? Industry sales for 1956 were $70 million where $55 to $60 million had been predicted. Sales for 1960 are now forecast at $350 million, with a projection of $450 million for 1961.

Quite a circle for our early American wireless telegraph crystal detector! And, when does an infant industry cease being an infant?

E. Willard Pennington

editor

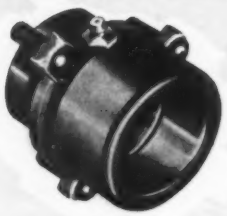
GUIDE PINS and GUIDE PIN BUSHINGS

Because high production, quality control and longer die life have become all-important, most stamping plants have now standardized on Lamina guide pins and Lamina bronze-plated bushings.

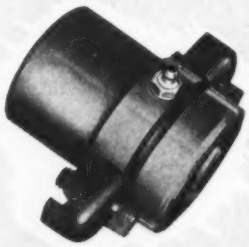
All Lamina wring-fit bushings are pre-finished on the I.D. Seated on a ground shoulder square with the surface of the die shoe and secured by special retainers, they assure distortion-free, full bearing surface that results in better die alignment, less maintenance and longer die life.

Lamina guide pins are special tool steel, heat treated, spray quenched, ground and burnished. The uniform, hard surface resists wear and the tough core prevents bending during installation or use. The pins are dimensionally accurate, do not "mushroom" or get out of round, and require no "running in".

There is a type and size Lamina Guide Pin and Bushing for every need. Our new catalog gives illustrations, applications, dimensions and prices of more than 800 items. Write for free copy.



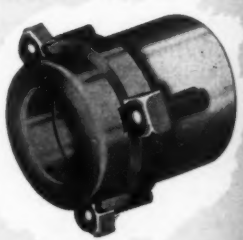
LONG SHOULDER TYPE—Small toe clamp. Use to keep guide pin in bushing during stroke. Long wearing bronze plated on hardened steel, ¾" to 3" pin dia.



HEAVY DUTY—Large toe clamp, for large and heavy die sets requiring extra body and shoulder thickness. Bronze plated, 2" to 3" pin diameter.

NUT TYPE—For wide range of requirements. Available in 5 sizes, 1" to 2" pin diameter, long-wearing bronze plated on hardened steel.

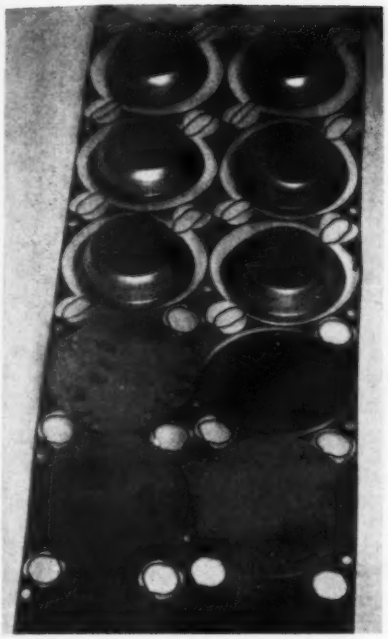
LONG SHOULDER TYPE—Large clamp. Long bearing surface contains pin during entire stroke. 2" to 3" pin diameter. Bronze on steel.



SHORT SHOULDER TYPE—For die space, more bearing area within die area. Bronze on steel or solid Ampco Bronze. 7 lengths, pin sizes ¾" to 2".

RING CLAMP TYPE—For heavy duty and bossed die sets. Bronze-plated steel or Ampco Bronze, 4 lengths, pin diameter 2½" to 4½".

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN



The scrap-leg carrier used in a double-row progressive die gives a substantial stock savings over the conventional double-cut (or double-round) technique.

TOOLING & PRODUCTION Magazine

For Drawn Stampings

SAVE STOCK WITH NEW CUT AND CARRY TECHNIQUE IN PROGRESSIVE DIES

by John Chismar
Chief Designer
THE SECTIONAL DIE COMPANY
Wellington, Ohio

THE SCRAP-LEG CARRIER, developed by our company, might be just the design you need to scale down the production cost for a drawn stamping that can be made in a large progressive die. One company for whom we built this carrier made a cost study showing they had a potential stock savings of close to $50,000 in one-year's production. Further, this same company estimated that if their other dies adaptable to this technique had employed it, they could have saved $107,000 in stock alone.

One part after 20 becomes yours in material, as the press rolls over and the part pitches to the next station. This type of carrier eliminates the extra stock you would otherwise have to purchase to transport the part through the press and then bale up and sell for scrap. It gives you more liberty to combine stations, shorten pitch, cut maintenance cost, and lets you squeeze that too-long progressive sequence into the press available.

Looking at Figure 1, you can see that the scrap in the corners of the strip skeleton was

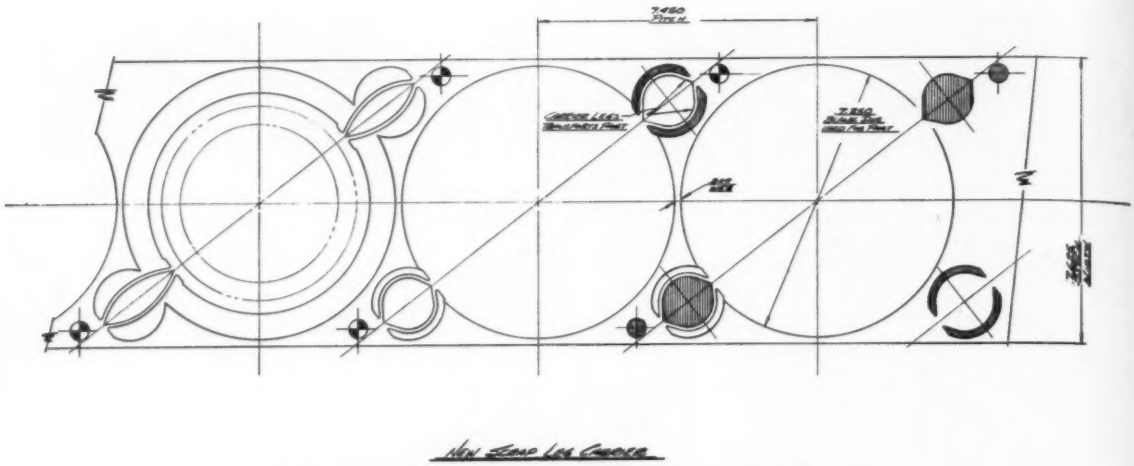


Fig. 1. This partial strip layout shows the scrap-leg carrier completely cut in one station, followed by an idle station, and first draw.

used to form the carrier. It is by use of these corners that we pick up our stock savings. The savings comes from not having to provide extra stock around the blank opening from which carrier legs can be drawn to transport the part through the die, as in a standard double-cut carrier (Fig. 2). The double-cut (also commonly called "double-lance" or "double-round") has been a highly successful type of carrier, but in the end it means extra stock to be baled up as scrap.

Figure 1, showing the strip layout through the first draw, needs little explanation. The important point is that the carrier legs must be designed for cutout in an elliptical shape, and must be calculated to give the full travel needed, without breaking off, when stretched in the direction of the drawn part.

Shape of the arc may vary with the blank and the depth of draw, but the scrap in the corners also increases with the size of the blank and, therefore, keeps up in proportion to the draw. The inside corners of the elliptical legs where attached to the blank and the scrap skeleton must be left sharp in order to allow the carrier legs to move close together as the part is being drawn; if this isn't done, you will find yourself in trouble as the legs will buckle and start to pile up.

These legs can take a lot as they move through the progressive die. Some of the presses equipped with dies for this type of carrier are now doing around a thousand strokes per hour, and the scrap leg carriers are hanging onto the parts like bulldogs. We have twisted cups a full 360° in one direction and

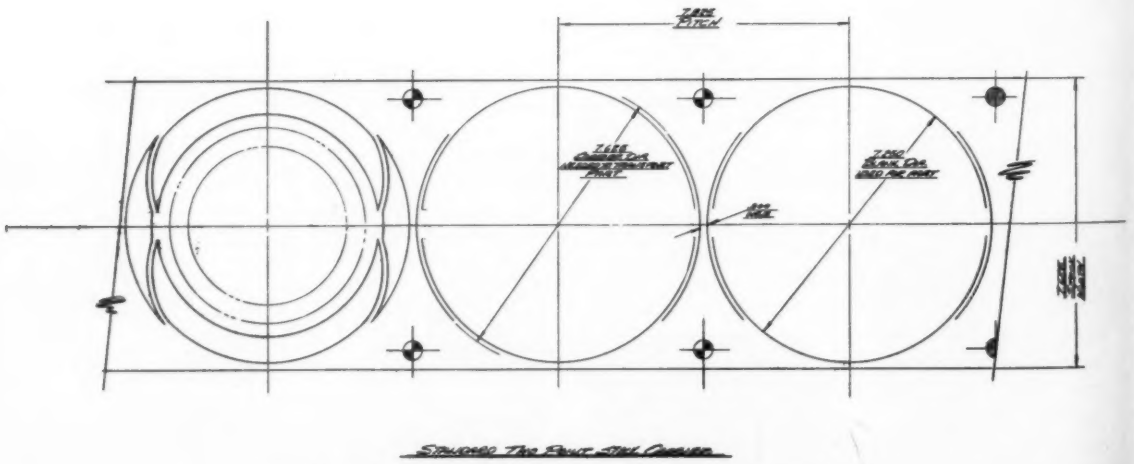


Fig. 2. A comparable strip layout for the standard one-station double-round cutout with lancing complete in one station, idle station, and first draw. Comparison with Figure 1 shows the extra stock required with this method of cut and carry.

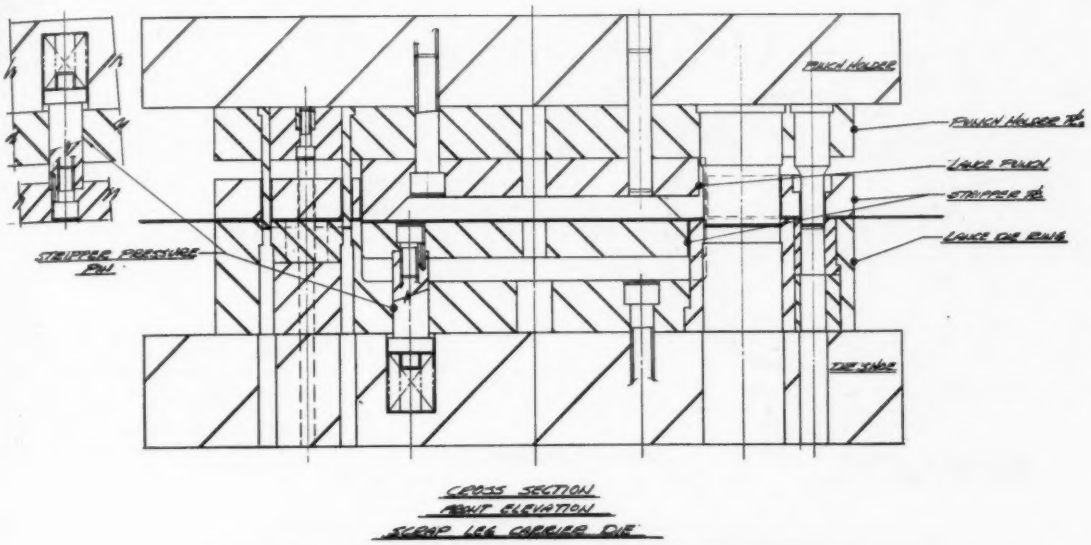


Fig. 3. Cross-sectional front elevation of the station for blanking the scrap-leg carrier. The stripper pressure pin design permits the diemaker to work entirely from the face of punch holder and die shoes in assembling the die.

then reversed the direction for another full 360°; after righting them, we cycled the press and sent the cups on through without any adverse results. The ability of this type carrier leg to move or stretch and return to position is as good or better than that of the double-cut carrier.

With the standard double-cut carrier, we have to leave a strip of stock around the blank from which our part is to be drawn; with the scrap-leg carrier, we use no more stock than we would on single crack dies.

The blank diameters in both Figures 1 and 2 is 7.250″. The width of the web needed in each case to maintain strength in the scrap skeleton is 0.200″. With the double-cut carrier in Figure 2, we must add 0.1875″ for each carrier leg. This gives a total of 7.825″, which becomes the pitch distance. This dimension multiplied by the stock width of 7.625″ gives a needed strip area of 59.666 sq in per blank.

Referring again to Figure 1 for the scrap-leg carrier, the pitch distance is made up only of the blank diameter of 7.250″ and the needed

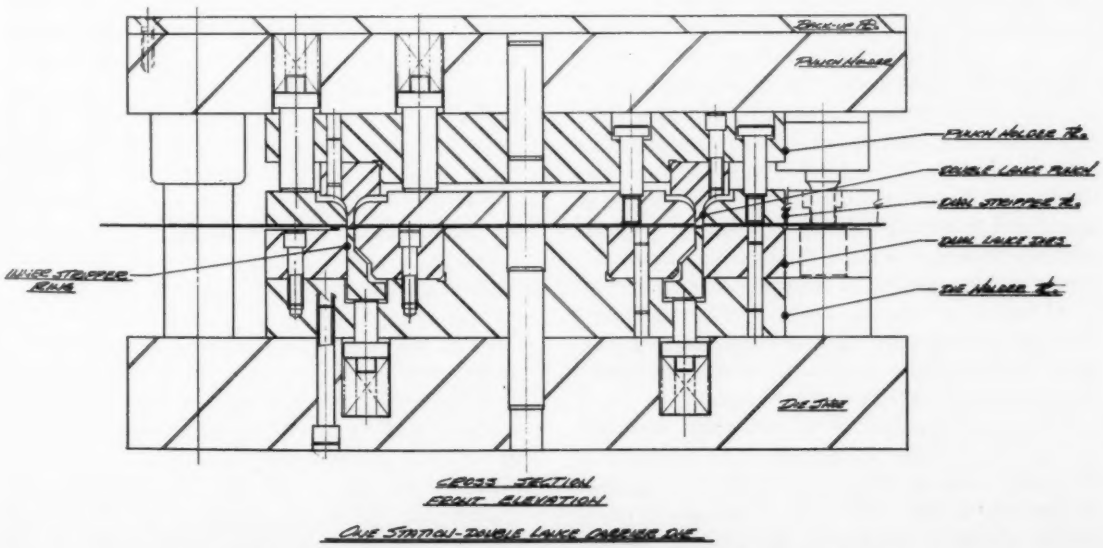


Fig. 4. Cross-sectional view of a station required for the standard double-cut carrier. The double lance punch and stripper rings are subject to distortion that is difficult to control.

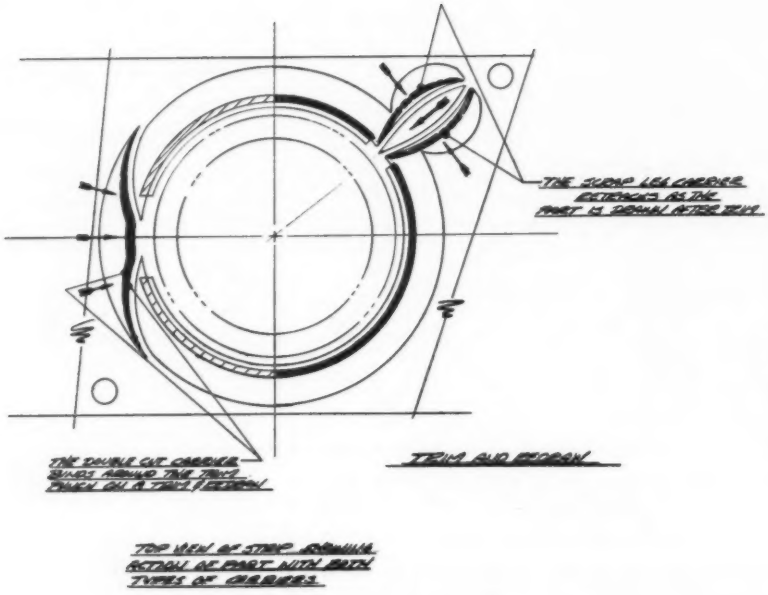

THE SCRAP LEG CARRIER RETRACTS AS THE PART IS DRAWN AFTER TRIM
THE DOUBLE CUT CARRIER SLIDES AROUND THE TRIM PUNCH ON A TRUE RADIUS
TRIM AND REDRAW
TOP VIEW OF STRIP SHOWING ACTUAL AS PART WITH BOTH TYPES OF CARRIERS

Fig. 5. Strip section showing the effect of both types of carrier at the trim and redraw station. Arrows show relative movement of material for the scrap-leg type carrier (upper right) and the double-cut (lower left), as cup is redrawn.

web width of 0.200" and is 7.450". Multiplying this by the stock width of 7.625" gives us a strip area of 56.806 sq in. Subtracting this from the 59.666 needed for the double-cut carrier shows a savings of 2.860 sq in/pc! On other blank diameters, the stock savings varies slightly each way in relation to the size of blank used.

After building three high production dies with this type of carrier, we find at Sectional Die Co. that the construction cost on the compound stations to produce the carriers is about the same on both types. But other benefits are high. Ease of assembly and maintenance is outstanding.

Figure 3 is a cross-section showing the construction of the first station of the new scrap-leg carrier die; compare it with Figure 4 which shows a standard single-station construction used on the double-cut. You will find fewer details in the scrap-leg construction, but the cost of making up your acorn punches and dies offsets what you save in this first station. The lance punch and die are made from one piece each and so are the strippers. In the double-cut construction, we find the two-part lance die requires two pieces of hollow bar stock; this runs into a lot of scrap chips to machine them. The double-lance punch and inner stripper ring also turn out to be hazardous details to make, because of distortion in heat treat.

Notice the design of the stripper pressure pin used on the scrap-leg die; this eliminates stripper bolts in this station and lets the die-maker work his whole die in assembly from the face side of the punch holder and the die shoe. Another good feature is that it allows pressure on the stripper only when the die is being compressed or in use.

If you have room in the die for the **two-station** double-cut, I think this cheaper design of making the round punch and die solid construction is still good; but, if you want an idle station before your draw station and need the room, the scrap-leg station construction is better than the one-station double-cut as far as cost of assembly is concerned.

Still another benefit of the scrap-leg carrier we found to be that, when you reach the first draw station, you obtain very little carrier resistance. This draw restriction created by collapsing the arc in the double-cut carrier, has always been a problem in getting a die through design and build; there is always some doubt until the progressive die is in tryout as to how much resistance will be picked up by your first draw station. This resistance determines your stock thin-out and the necessary trim and must be accurately anticipated by the conscientious dieman, who has to leave just the correct amount of trim-pitch or incur considerable expense in either subsequent modification of the original construction or wasted stock in providing a safety factor.

With the scrap-leg carrier, the resistance depreciates at the very beginning of the draw; and, therefore, you can use the standard blank without adding a safety factor. In Figure 5 are arrows showing the direction of material flow in each type of carrier leg. Although this illustration shows the action at the trim and redraw station, it conveys also a picture of what happens in the initial draw. Positions of

. . . Continued on page 101

Algebraic Model Helps Make Decisions on Machine Tool Replacement

by Edward C. Varnum
Head, Operations Research
BARBER-COLMAN COMPANY
Rockford, Illinois

The Barber-Colman version of the MAPI formula employs an easy-to-use algebraic model to build basic tables from which a more realistic "uniform annual equivalent" is quickly determined.

MANY PROBLEMS OF SCIENCE are solved by devising an algebraic model to mirror the behavior of the physical or chemical system under study. An algebraic model uses mathematical symbols and expressions to build algebraic equations that are analogs of the relationships existing in the system itself. When the results derived from the algebraic model are used in an actual system, the operation of the system satisfies the specified requirements.

A simple problem, similar to that found in any high school algebra book, will illustrate the principles that underlie algebraic models. Consider such a problem:

> "Elvis has 5 pencils and 2 erasers for which he paid a total of 9¢, while Marilyn has 3 pencils and 1 eraser for which she paid 5¢. What is the price of a pencil?"

The algebraic model for this problem consists of letting one symbol, x, represent the price of a single pencil and another symbol, y, represent the price of a single eraser. Using these symbols, the two relationships described in the economic system above can be mirrored by the following algebraic equations:

$$5x + 2y = 9, \text{ and } 3x + y = 5 \quad . \quad . \quad . \quad . \quad (1)$$

Having set up an algebraic model of our problem, we can promptly forget all about pencils and pennies and address ourselves only to the mathematical processes involved in solving the problem described in (1). Application of these processes yields a value of unity (one) for the symbol x. We now translate back into the language of the problem and answer the question with the statement, "A pencil costs a penny."

The Barber-Colman machinery replacement model involves more complicated symbolism than (1), but essentially the process is identical. Instead of x and y for unit pencil and eraser costs, we use the symbols c, N, i, and s for capital cost, service life, interest rate, and salvage value, respectively. And then we set up algebraic relationships in the same general way as we derived (1).

After performing the required algebraic manipulations to derive an expression for the "cost" of a new or other proposed machine, a table of numerical values is calculated for practical use. In solving actual machinery replacement problems, then, *the equipment analyst uses none of the algebra directly but simply finds the proper number in the table and multiplies it by the total investment in the machine.*

Fig. 1. The horizontal boring machine analyzed in Figure 3 for acquisition on an economic basis, is shown in subsequent operation in Dept. 1251 of Barber-Colman Company. This is one of hundreds of pieces of plant and office equipment analyzed and purchased in a similar manner.

In its first formulation, the MAPI (Machinery and Allied Products Institute) theory of replacement assumed the existence of a *constant operating inferiority gradient.* This four-word term can be loosely described by saying that a machine gets worse by the same amount each year, viz., if the operating inferiority was $300 last year and is $400 this year, then it will be $500 next year. In this case, the constant operating inferiority gradient is $100. (In theory, the operating inferiority is made up of both deterioration and obsolescence.) Although there are moves underway to modify this assumption about the constancy of the change, we continue to use the initial choice of MAPI's Research Director, George Terborgh.

Originally the MAPI system made no adjustments for the impact of federal income taxes, but simply stated that i symbolized the interest rate. The basic contribution of the Barber-Colman version presented here is the treatment of this important factor by considering an income tax factor, b, and an after-tax rate, i, along with a definite depreciation pattern described later.

We define the *uniform annual equivalent* in this article to be the periodical payment of a level annuity — the present worth of which is the capital cost, plus the present worths of all operating inferiorities and tax payments, minus the present worth of the salvage value . . . if any.

In case of no salvage value, the *service life* is defined to be the time at which the uniform annual equivalent is equalled by the machine's operating inferiority for the following year. Our experience with the earlier concept of a minimum uniform annual equivalent advocated by MAPI has shown that this definition of service life yields comparable practical results. At the end of its service life the machine should be replaced, because during the next year the operating inferiority would absorb all of the uniform annual equivalent and, theoretically, nothing would be returned to capital.

In case there is a salvage value, we define a *depreciation life* (longer than the service life) in such a way that the undepreciated balance at the end of the service life equals the salvage value. We then say that the uniform annual equivalent for the last year of the depreciation life shall be equal to the next year's operating inferiority.

In either the no-salvage or salvage value case, we use the uniform annual equivalent corresponding to the service life in our replacement analyses. This value is called u* (u-star) to distinguish it from the value of u for any (arbitrary) number of years. In actual application we have found that results based on the above assumptions agree favorably with our earlier experience, although the new figures are lower because of the beneficial effect of depreciation allowances on tax payments.

The Barber-Colman version of the MAPI formula retains the basic principle, i.e., we calculate the uniform annual equivalent for the new or other proposed machine (challenger) according to its estimated service life. Then we calculate the operating inferiority of the present machine (defender) as compared to the proposed machine, increased by the annual cost of capital additions to the present machine if necessary. If the first value (for the proposed machine) is less than the second, purchase of the new machine is recommended.

In order to find the (uniform annual equivalent) first value above, our Methods Department analyst determines the capital cost, service life, and salvage value (of the proposed machine at the end of its service life). *A salvage value ratio* is found by dividing the salvage value by the capital cost. From a numerical table (Fig. 2) provided by Operations Research, the analyst uses the service life and the salvage value ratio to find a multiplier. This is multiplied by the capital cost to find the proposed machine's *annual average cost.*

Mathematical Derivation of Table

As in the simple Elvis-Marilyn problem, we first represent various numerical values by

algebraic symbols. These are listed in the box below.

SYMBOLS USED IN BARBER-COLMAN MAPI FORMULATIONS

- b = federal income tax rate, in decimals
- c = capital cost of new machine, in dollars
- i = after-tax interest rate, in decimals
- j = integer to designate arbitrary year
- n = an arbitrary number of years
- N = estimated service life, in years
- $r = s/c$ = salvage value ratio, in decimals
- s = salvage value at end of service life, in dollars
- t = present worth of n tax payments, in dollars
- u = uniform annual equivalent for n years, in dollars
- u^* = uniform annual equivalent for N years, in dollars
- $v = 1/(1 + i)$
- w = present worth of operating inferiorities for n years, in dollars
- x = depreciation life, in years

Using these symbols, we express the present worth of (1) capital cost, (2) operating inferiorities, (3) tax payments, and (4) salvage value. We then determine a level annuity whose annual payment is u, and whose present value is the sum of (1), (2) and (3), minus (4). The formula for u will contain linear expressions in u^* because of our operating inferiority assumptions, and thus for $n = N$, we set $u = u^*$ and solve for u^* as will be shown.

The present worth of the capital cost is the capital cost itself, c.

For the present worth of the operating inferiorities, we note that there is no operating inferiority the first year, because the machine is new and therefore it is as good as the best available machine. For the second year, however, a small operating inferiority arises. In accord with our fundamental assumption described above, this value is u^*/x. For the third year, the operating inferiority is $2u^*/x$, and for the fourth year, it is $3u^*/x$; so, in general, we can say that for $j = 1, 2, 3, \ldots, N$

$$\frac{u^*}{x}(j\text{-}1) = \text{operating inferiority for the jth year} \quad \ldots\ldots (2)$$

To find the present worth, we multiply by the jth power of v:

$$\frac{u^*}{x}(j\text{-}1)v^j = \text{present worth of operating inferiority for jth year}$$

The total of the present worths of all operating inferiorities for n years is given by the expression:

$$w = \sum_{j=1}^{n} \frac{u^*}{x}(j\text{-}1)v^j \quad \ldots\ldots\ldots (3)$$

In order to calculate tax payments, we assume that the capital recovery period is identical with the allowable depreciation life. Even though this relationship does not always exist in practice, we feel that this is a reasonable averaging assumption.

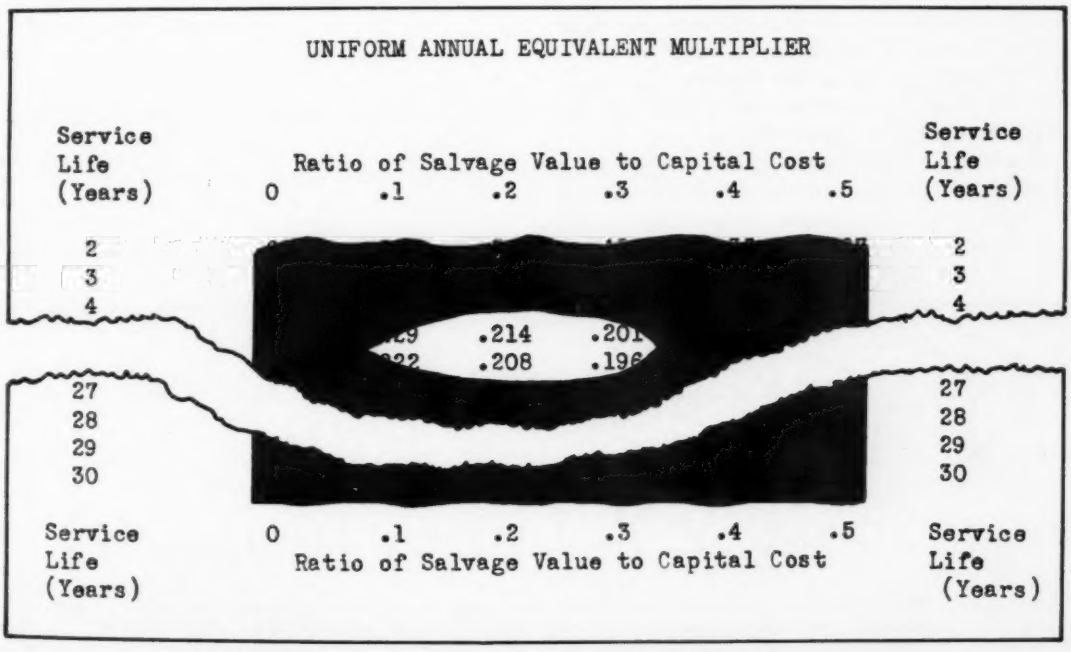


Fig. 2. Physical form of the table of numerical values needed for a more accurate calculation of "uniform annual equivalent." The values shown have been deliberately shifted, since they would have no direct application for another company.

ALGEBRAIC MODELS AND O-R

Although Algebraic models have had their primary use in natural sciences, particularly Physics, they are now being applied to Economics, with examples in such fields of industrial application as the size of manufactured lots. This transfer of mathematical methods from the area of pure scientific research as practiced in university laboratories to the conduct of industrial enterprises characterizes the activity known as Operations Research.

The author's interest in the mathematical aspects of machinery replacement as advocated by the Machinery and Allied Products Institute began earlier than his formal adoption of the Operations Research title early in 1952. It was then recognized that the MAPI formulation of equipment policy fell directly in line with O-R development.

The theories and practices described here were completed by the author early in 1956, and the numerical results have been in use at the Company for many months. Considerable assistance and encouragement by other individuals in the Company and on the MAPI staff have contributed to development of the theory which, after all, is merely an extension of the original MAPI concept.

The depreciation method used in our algebraic model is a combination of the double-declining-balance and the straight-line methods for the first and second halves of the depreciation life, respectively.

The double-declining-balance method uses a rate which is twice the depreciated amount divided by the depreciation life. This double rate is applied to the undepreciated balance.

For example, a $1000 item depreciated over 10 yrs would depreciate $200 the first year, leaving a balance of $800. The second year's depreciation would be 20% of $800, or $160. With c being capital cost and x the depreciation life, the first year's depreciation may be expressed as 2c/x and the balance as c-(2c/x). The second year's depreciation will be 2/x times this balance, or $\frac{2c}{x}\left(\frac{x-2}{x}\right)$. The third year's depreciation is $\frac{2c}{x}\left(\frac{x-2}{x}\right)^2$; and, in general, the jth year's depreciation can be expressed as $\frac{2c}{x}\left(\frac{x-2}{x}\right)^{j-1}$. We say that this expresses our depreciation when j is less than $\frac{1}{2}x$. When j is more than $\frac{1}{2}x$, we use straight-line (uniform) depreciation, expressed by $\frac{2c}{x}\left(\frac{x-2}{x}\right)^{\frac{1}{2}x}$.

To find the tax payment for the arbitrary jth year, we subtract the depreciation from the difference between the operating inferiority and the value of u* and then multiply by the tax rate:

$$b\left[u^* - \frac{u^*}{x}(j\text{-}1) - \frac{2c}{x}\left(\frac{x-2}{x}\right)^{j-1}\right] = \text{tax for jth year, when } j \leq \tfrac{1}{2}x$$

$$b\left[u^* - \frac{u^*}{x}(j\text{-}1) - \frac{2c}{x}\left(\frac{x-2}{x}\right)^{\frac{1}{2}x}\right] = \text{tax for jth year, when } j > \tfrac{1}{2}x$$

The present worth of all tax payments for $j = 1, 2, 3, \ldots n$, is shown in formula (4).

The present worth of the salvage value is sv^n or rcv^n.

The total present worth of our level annuity is $(c\text{-}rcv^n + w + t)$. Using an interest rate i,

$$t = b\left[\sum_{j=1}^{n}\left[u^* - \frac{u^*}{x}(j\text{-}1)\right]v^j - \sum_{j=1}^{\frac{1}{2}x}\frac{2c}{x}\left(\frac{x-2}{x}\right)^{j-1}v^j - \sum_{j=\frac{1}{2}x\,1}^{n}\frac{2c}{x}\left(\frac{x-2}{x}\right)^{\frac{1}{2}x}v^j\right] \quad . \quad . \quad (4)$$

$$u^* = \left(\frac{ic}{1\text{-}b}\right)\frac{1 - \dfrac{2b\left[1 - \left(\dfrac{x-2}{x}v\right)^{x/2}\right]}{2 + ix} - \dfrac{2b}{ix}\left(\dfrac{x-2}{x}v\right)^{x/2}\left(1 - v^{N-x/2}\right) - rv^N}{\left(1 - v^N\right)\left(1 - \dfrac{1}{ix}\right) + \dfrac{Nv^N}{x}} \quad . \quad . \quad (6)$$

TABLE I

Values of u*/c for No-Salvage Case
50% Tax Rate and After-Tax Interest Rates of 5%, 6% or 7%

N	5%	6%	7%
2	.7451613076	.7610256502	.7769426854
3	.5787764670	.5947191206	.6107213806
4	.4784653078	.4943803588	.5103657912
5	.4115322152	.4274308230	.4434111598
6	.3637299174	.3796291728	.3956215208
7	.3279015666	.3438152156	.3598331634
8	.3000624020	.3160006680	.3320542082
9	.2778185296	.2937889400	.3098853326
10	.2596453038	.2756534272	.2917979534
11	.2445257048	.2605756900	.2767721982
12	.2317553394	.2478502924	.2641015804
13	.2208309030	.2369731528	.2532812348
14	.2113832080	.2275744932	.2439407900
15	.2031353038	.2193769000	.2358023844
16	.1958753670	.2121682122	.2286534820
17	.1894386202	.2057833700	.2223287418
18	.1836949588	.1981483124	.2166976090
19	.1785402872	.1949899130	.2116556230
20	.1738903288	.1903926022	.2071182090
21	.1696761240	.1862310120	.2030161660
22	.1658407014	.1824480680	.1992923176
23	.1623365812	.1789962060	.1958990176
24	.1591238780	.1758354684	.1927962402
25	.1561688408	.1729320436	.1899501174
26	.1534427170	.1702571282	.1873317986
27	.1509208604	.1677860328	.1849165554
28	.1485820238	.1654974730	.1826830718
29	.1464077924	.1633730028	.1806128752
30	.1443821268	.1613965566	.1786898788

the annual payment of an n year annuity having this present worth is

$$u = (c\text{-}rcv^n + w + t)\left[\frac{i}{1\text{-}v^*}\right] \quad . \quad . \quad . \quad . \quad (5)$$

where the factor in the bracket is the customary factor for converting present value to periodic payment.

We now substitute (3) and (4) into (5) to obtain a relationship between u and a complicated function of b, c, r, n, and u*. We next recall that n = N when u = u*. Inserting this information into the equation, we arrive at an equation containing b, c, r, i, N and u*, but which is linear in u*. Thus, we can solve for u* as in formula (6).

In the no-salvage case, equation (6) is simplified because x = N. If we simplify further by assuming a 50 % tax rate, i.e., a value of 0.50 for b, and divide through by c, we can write formula (6').

Table I shows the evaluation of the right-hand member of equation (6') — equivalent to u*/c — by electronic computer, for N running from 2 to 30 and for after-tax interest rates of 5%, 6 % and 7%. The computer required an average of 13 min to calculate and print each of the 10-decimal columns shown in Table I.

Each of the 10-decimal entries of Table I represents a solution to a specific problem for corresponding values of N and i. Table II shows the numerical details year-by-year for a machine having an estimated service life of 14 yrs where the 5% interest rate is assumed, and with the other assumptions common to all entries of Table I. For this example, we rounded off all values to the nearest dollar and chose a convenient value of $100,000 for the capital cost.

Table II provides a check on the accuracy of the 14-yr, 5% entry in Table I and, in addition, is a numerical example of the relationships between operating inferiorities, tax allowances for depreciation, and method of repayment of capital cost. The $3 balance shown for the 14th year is due to the rounding off of entries and represents a very small fraction of the $100,000 initial balance.

When we estimate that there will be a salvage value for the new machine at the end of its service life, we must return to equation (6) rather than use the simplified form (6'). For relatively small salvage values, the service life will be more than half of the depreciation life. In order to facilitate electronic calculation, we express (6) by three shorter formulas (7), (8), and (9) when N is more than $\frac{1}{2}x$:

$$u^*/c = PQ \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

$$\frac{u^*}{c} = \frac{2Ni^2}{iN + (1+i)^{-N} - 1}\left\{1 + \frac{\left(\sqrt{\frac{N-2}{N+iN}}\right)^N - 1}{iN+2} - \frac{\left(\sqrt{\frac{N-2}{N+iN}}\right)^N \left[1 - \left(\sqrt{1+i}\right)^{-N}\right]}{iN}\right\} \quad . \quad . \quad . \quad (6')$$

$$P = \left(\frac{i}{1\text{-}b}\right)\frac{1}{(1\text{-}v^N)\left[1 - \frac{1}{1x}\right] + \frac{Nv^N}{x}} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

$$Q = 1 - \frac{2b\left[1 - \left(\frac{x-2}{x}v\right)^{\frac{1}{2}x}\right]}{2 + ix} - \frac{2b}{ix}\left(\frac{x-2}{x}v\right)^{\frac{1}{2}x}\left[1 - v^{N-\frac{1}{2}x}\right] - rv^N \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

TABLE II

Payment Schedule for a $100,000 Machine

No Salvage Value

14-yr. Service Life, 5% Interest Rate, 50% Tax Rate

Yr.	Depreciation	Operating Inferiority	Taxable Earnings	Tax Payment	Total Available for Capital	Interest Payment	Principal Payment	Principal Balance
1	14286	0	6852	3426	17712	5000	12712	87288
2	12245	1510	7383	3692	15936	4364	11572	75716
3	10496	3020	7622	3811	14307	3786	10521	65195
4	8996	4530	7612	3806	12802	3260	9542	55653
5	7711	6039	7388	2694	11405	2783	8622	47031
6	6609	7549	6980	3490	10099	2352	7747	39284
7	5665	9059	6414	3207	8872	1964	6908	32376
8	4856	10569	5713	2856	7713	1619	6094	26282
9	4856	12079	4203	2102	6957	1314	5643	20639
10	4856	13589	2693	1346	6203	1032	5171	15468
11	4856	15098	1184	592	5448	773	4675	10793
12	4856	16608	—326	—163	4693	540	4153	6640
13	4856	18118	—1836	—918	3938	332	3606	3034
14	4856	19628	—3346	—1673	3183	152	3031	3

Notes:

1. **The first depreciation allowance is 1/7 of $100,000.**
2. **The last seven depreciation allowances are equal.**
3. **The total depreciation is $100,000.**
4. **The first operating inferiority is zero.**
5. **The second operating inferiority is 1/14th of $21,138.32 to the nearest dollar, where the entry of Table I for 14 yrs and 5% (0.2113832080) is used.**
6. **Taxable earnings are found by subtracting the depreciation and the operating inferiorities from $21,138 ($u^*$).**
7. **Total earnings available for capital are found by subtracting taxes and operating inferiorities from u^*.**
8. **Interest is 5% of the previous year's balance, etc.**

For large salvage values, N will be less than half the depreciation life so that (6) can again be reduced to a single equation, given as (10) below.

To apply formulas (7) through (10), we need to find x for given values of N and r. Where the depreciation life is less than twice the service life, we can find x by solving the following equation:

$$\frac{r}{x-N} = \frac{2}{x}\left(\frac{x-2}{x}\right)^{\frac{1}{2}x} \quad \ldots\ldots\ldots \quad (11)$$

Each side of (11) represents the annual depreciation during the second half of the depreciation life. For our purpose, we solved for x by evaluating $(x-N)\ \frac{2}{x}\left(\frac{x-2}{x}\right)^{\frac{1}{2}x}$ for integral values of x and found consecutive integers for which the expression was closest to r. Then we chose the even integer as our practical value of x.

When the depreciation life is more than twice the service life, we can set the total depreciation for the service life equal to the difference between the capital cost and the salvage value:

$$\sum_{j=1}^{N} \frac{2c}{x}\left(\frac{x-2}{x}\right)^{j-1} = c - s \quad \ldots\ldots \quad (12)$$

This equation can be solved explicitly for x:

$$x = \frac{2}{1 - \frac{N}{\sqrt{r}}} \quad \ldots\ldots\ldots \quad (13)$$

To determine whether to use (11) or (13) to find x, we may assume that $x = 2N$ in either case and find the value of r:

$$r = \left(\frac{N-1}{N}\right)^{N} \quad \ldots\ldots\ldots \quad (14)$$

For values of N ranging from 4 to 100, values of r in (14) range from 0.3488 to 0.3660. Thus, for all practical purposes, we can set the change-over value of r at 0.35.

In building our analysts' table of uniform annual equivalent multipliers (Fig. 2), we calculate u^*/c for salvage ratio value (r) in steps of 0.1 and for service life (N) from 2 to 30. We first calculated proper values for x, rounded to the nearest even integer, using (11). Then we

$$\frac{u^*}{c} = \left(\frac{i}{1-b}\right) \frac{1 - 2b\left[1 - \left(\frac{x-2}{x}v\right)^{N}\right] - rv^{N}}{2 + ix} \Bigg/ \left(1 - v^{N}\right)\left(1 - \frac{1}{ix}\right) + \frac{Nv^{N}}{x} \quad \ldots\ldots \quad (10)$$

calculated x values for r values of 0.4 and 0.5 using (13).

Inasmuch as these x values are completely independent of b, c, and i, they are given in Table III. An electronic computer was programmed to calculate the values of Table III, and selected values were checked by desk calculator.

With the values of x given in Table III, we next calculated P values from (8) and Q values from (9), for r values of 0.1, 0.2, and 0.3. Then the corresponding P and Q values were multiplied together (7) to form the final table of values for u*/c. For r values of 0.4 and 0.5, equation (10) is used. However, in nearly every actual case, the salvage value ratio is less than 35% of the capital cost, so equations (10), (12), and (13) are primarily of academic interest.

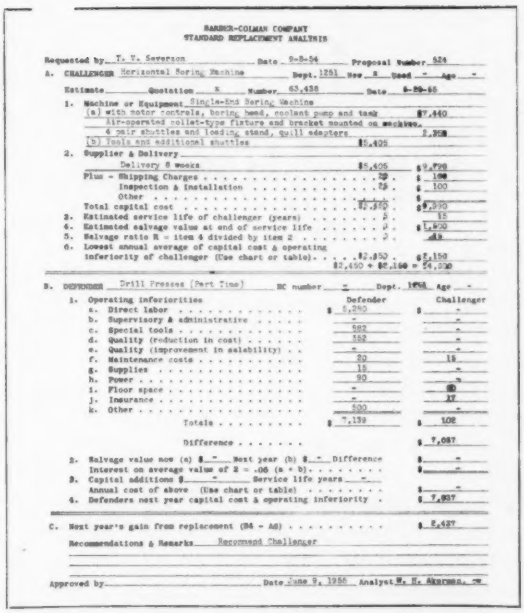
Application of Table

The final table of uniform annual equivalent multipliers (Fig. 2) is included in the Barber-Colman "Replacement Analysis Manual" for use by our Methods Department analysts to calculate a single number which represents the new machine's "cost." (See item A6 in the replacement form, Fig. 3).

The old machine's "cost" is calculated by listing its disadvantages (operating inferiorities) in comparison with the new machine with respect to various elements, the most important of which is generally *direct labor*. Sometimes one of the other listed factors is dominant, and occasionally the greatest contribution to the old machine's "cost" is listed under *other* and represents safety, morale, or advertising value. Generally, most of the items listed in the replacement form under *operating inferiorities* contribute little to the final results but are listed for the sake of complete accuracy.

TABLE III
Depreciation Lives (x)
For Various Service Lives and Salvage Value Ratios

Service Life	Salvage Value Ratios				
N	r = 0.1	r = 0.2	r = 0.3	r = 0.4	r = 0.5
4	4	6	8	10	12
5	6	8	10	12	16
6	8	8	10	14	18
7	8	10	12	16	22
8	10	12	14	18	24
9	10	12	16	20	26
10	12	14	18	22	30
11	12	16	20	26	32
12	14	16	22	28	36
13	16	18	22	30	38
14	16	20	24	32	42
15	18	22	26	34	44
16	18	22	28	36	48
17	20	24	30	38	50
18	22	26	32	40	52
19	22	26	32	42	56
20	24	28	34	44	58
21	24	30	36	46	62
22	26	30	38	50	64
23	26	32	40	52	68
24	28	34	42	54	70
25	30	34	42	56	74
26	30	36	44	58	76
27	32	38	46	60	78
28	32	38	48	62	82
29	34	40	50	64	84
30	34	42	52	66	88



BARBER-COLMAN COMPANY
STANDARD REPLACEMENT ANALYSIS

Requested by T. V. Severson Date 9-8-54 Proposal Number 524

A. CHALLENGER Horizontal Boring Machine Dept. 1251 New X Used — Age —

Estimate — Quotation X Number 63,436 Date 8-29-55

1. Machine or Equipment Single-End Boring Machine
   (a) with motor controls, boring head, coolant pump and tank — $7,440
   Air-operated collet-type fixture and bracket mounted on machine, 4 pair shuttles and loading, stand, quill adapters — 2,958
   (b) Tools and additional shuttles — $5,405
2. Supplier & Delivery
   Delivery 8 weeks — $5,405 — $ 5,720
   Plus - Shipping Charges . . . . . 2% . $ 108
   Inspection & Installation . . . . . 2% . $ 100
   Other . . . . . $
   Total capital cost . . . . . $5,940 . $ 5,940
3. Estimated service life of challenger (years) . . . . . N . 15
4. Estimated salvage value at end of service life . . . . . S . $ 1,430
5. Salvage ratio R = item 4 divided by item 2 . . . . . R . .25
6. Lowest annual average of capital cost & operating inferiority of challenger (Use chart or table). . . . $2,450 + $2,160 = $4,610

B. DEFENDER Drill Presses (Part Time) BC number — Dept. 1258 Age —

	Defender	Challenger
1. Operating inferiorities		
a. Direct labor	$ 5,280	$ —
b. Supervisory & administrative	—	—
c. Special tools	582	—
d. Quality (reduction in cost)	582	—
e. Quality (improvement in salability)	—	—
f. Maintenance costs	50	18
g. Supplies	15	—
h. Power	90	—
i. Floor space	—	60
j. Insurance	—	17
k. Other	500	—
Totals	$ 7,139	$ 105
Difference		$ 7,087
2. Salvage value now (a) $ — Next year (b) $ — Difference		$ —
Interest on average value of $ — .06 (a + b)		$ —
3. Capital additions $ — Service life years —		
Annual cost of above (Use chart or table)		$ —
4. Defenders next year capital cost & operating inferiority		$ 7,937
C. Next year's gain from replacement (B4 - A6)		$ 2,427

Recommendations & Remarks Recommend Challenger

Approved by Date June 9, 1956 Analyst W. E. Akerman

Fig. 3. Barber-Colman's standard replacement analysis form, showing the actual figures used in one specific case. On this form, the proposed (new) basic machine and its tooling are considered separately. For the machine itself, we see that N is 15, r is 0.15, c is $9,990 and u* is $2,150. For the tooling, N is 5, r is 0, c is $5,450, and u* is $2,450. The final u* is their sum, $4,600. The operating inferiority of the "old" machine is $7,037 in which the $5,280 direct labor saving is dominant. The decision figure (B4 — A6) is $2,437, so replacement is recommended. Figure 1 shows the equipment installed and in operation in accord with this recommendation.

The two "cost" figures, A6 and B4 in Figure 3, are compared to arrive at the decision regarding replacement. In actual practice, the analyst quickly filters out those proposals for which A6 is larger than B4, so the only forms which upper management sees are those for which replacement is recommended.

Tailor the Table

The proper values to use in any company for the tax rate, b, and the after-tax interest rate, i, are top management decisions which depend on the basic financial structure of the company and its tax bracket position. Once these numerical values are determined, equations (6) and (6′) can be used to construct a table of u*/c values for reasonable values of N and r.

At Barber-Colman Company, we have used the above procedures to assist in making decisions concerning new methods and expansion as well as for the machine-for-machine replacements which the strict language of the above paragraphs implies.

end

INGENIOUS LATHE TOOLS FOR DIMPLING AND CHAMFERING

by W. M. Halliday
Southport, England

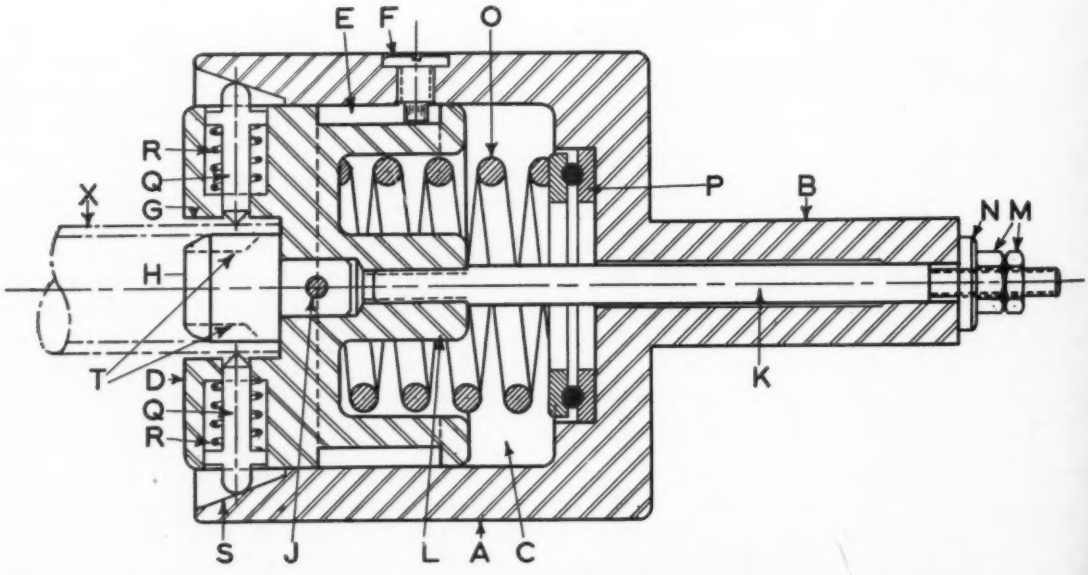
FABRICATING A COMPONENT for an adjustable electric lamp, required that large quantities of ⅝″ OD x ½″ ID soft aluminum tubing be cut to 14″ overall length, with ends finished square. Near one end of each piece, two small conical dimples had to be formed in the 1/16″ wall, diametrically opposite and 7/32″ from the trued-up end.

It was essential that the dimples be of the greatest possible depth without penetrating the thin wall. Because of this requirement, it was found impractical to use a drill point.

In final assembly, two small insulated wires had to be pulled through each tube. Because there was ample clearance for them, it was found feasible to indent the two dimples to meet the required conditions.

These tubes were components of an adjustable electric lamp that was designed for manufacture by the pressure diecasting process. Each tube became an insert in the die casting. In the diecasting process a cylindrical boss of alloy was cast around the outside of the dimpled end of the tubes, thus filling the dimples with alloy and providing a positive key to prevent the tube from being turned or pulled out of the diecast housing.

Originally, the tubes were dimpled by a separate operation on a light bench press, after the tubes had been cut to length on a lathe. This method proved far too slow, and involved additional handling and transportation of tubes between lathe and press. Therefore, it was necessary to develop a more efficient means of



Indenting two dimples diametrically opposite and near one end of 1/16″ wall soft aluminum tubing, presented a difficult problem until the dimpling tool shown was developed. Dimpling and cutting off 14″ lengths can be performed in rapid succession.

dimpling before cutting the tubing to the 14" length.

The simple and inexpensive dimpling tool that has been developed is shown in the accompanying drawing. Its use has almost doubled production over the press method. The accuracy of dimple location, quality of finish, and reduction of scrap has improved to a marked degree.

DIMPLING TOOL PARTS

A	Main cylindrical body	L	Boss on cage
B	Body shank	M	Locknuts
C	Bored hole in body	N	Steel washer
D	Cage-dimpling punch holder	O	Coiled compression spring
E	Groove in periphery of cage	P	Ball thrust bearing
F	Locking screw	Q	Dimpling punches
G	Recess bored in cage	R	Light compression spring
H	Horn, case hardened steel	S	Conical form in body (cam)
J	Pin	T	V-slots in horn
K	Steel rod	X	Aluminum tube

Operation of Dimpling Tool

The operation of this tool is simple, rapid, and effective. A long length of aluminum is held in the lathe chuck, or collet, in the usual manner, allowing it to project about 1¼" out of the chuck for facing the end. This amount of projection is also sufficient for the dimpling operation.

After facing, the dimpling tool, held in the lathe turret, is advanced so that recess G passes over the tube and horn H enters its bore. During this stage punches Q are retracted with their pointed ends clear of the tube due to the pressure of springs O and R. Spring O holds cage D in the maximum outward position in bore C according to the pre-setting of nuts M.

As the end of the tube bears against the base of recess G, further leftward movement of the tool is not transmitted to cage D and rod K, because these members telescope within the body A. As this movement occurs the rounded ends of punches Q ride down the conical sides S (a cam action) and thus are depressed the same amount simultaneously within the cage. Thus both punches are pressed into the wall of the tube and form the required dimples by pushing the wall metal into the V-slots T located in horn H. The usual positive stop will be set to stop the lathe carriage and dimpling tool when the dimples have been sunk to the correct depth.

In performing the dimpling operation the lathe spindle and tube X continue to rotate; this turning movement being transmitted to cage D when the end of the tube bears against the bottom of recess G. The ball-thrust bearing P insures the free and smooth rotation of the cage within the body.

When the tool is being withdrawn from the dimpled tube, the compressed spring O holds the sliding cage D in position until the body A has moved to the right a sufficient distance to bring its shank against the washer N on rod K. During this period, punches Q gradually retract under the pressure of their individual springs R, until their ends are clear of the tube. Continued withdrawal of the turret slide disengages the tool completely from the tube X. The collet is then opened, allowing the tube to be advanced to a turret stop, 14" from the cutoff tool mounted on the cross slide. After the piece is cut off, about 1¼" of tubing projects beyond the collet, ready for the dimpling operation. Since the lathe is not stopped for collet release and tube advance for cutoff, the dimpling operation can be performed with considerable rapidity, insuring a rate of production far faster than that possible by a separate manually-operated press-tool.

The dimples can be produced to close precision limits with respect to their sizes and locations from the end of the tube. The depth of the impressions may be varied merely by changing the setting of lock-nuts M along rod K.

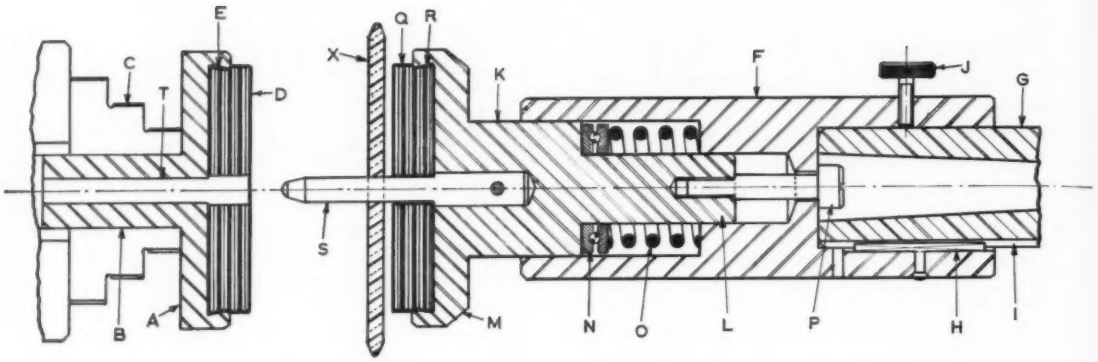
More than two punches may be mounted within the cage D so as to be operated simultaneously. Furthermore, the various punches need not necessarily be located the same distance from the end of the tube.

The working ends of the punches may easily be modified in shape and size to reproduce a variety of impressions other than conical. For example: punches may be designed to press v-notches across or along the tube; cut square, rectangular, triangular, polyonal or irregular shaped openings through the walls; or patterns not normally producible by drilling or conventional machining. Punches may also be adapted for impressing figures, lettering, or inscriptions on the tube surfaces.

These, and other useful, timesaving adaptations of this tool, should prove of interest to tool designers and machinists.

MACHINING THE PERIPHERIES of large quantities of aluminum discs, 5¼" dia x ⅛" thick, presented a locating and holding problem for lathe operation. The discs were blanked slightly over 5¼" dia with a pierced ⅜" dia center hole.

It was required that the rims of these discs be chamfered exactly 60° on each side to form a conical cross-section and that the crest of the coned form be rounded with a small but accurately formed radius. Close limits had to be held on sizing the inclined sides and the OD (5¼") measured over the rounded crests of the periphery.



Chamfering the rim of 1/8" thick soft aluminum discs to close tolerances posed a difficult locating and holding problem until the arbor shown was devised. Hard rubber blocks serve to grip and drive the discs.

Owing to the softness of the aluminum alloy, considerable difficulty was experienced in gripping the discs safely, rapidly, and with precision for the chamfering.

It was evident a holding fixture was required that would enable the chamfer and cresting operations to be performed by a single tool at one setup.

Because of the small center hole, the discs could not be mounted on any ordinary solid mandrel. Mounting the parts on a solid mandrel with large diameter side-supporting collars and clamped with a nut was attempted. Loading and unloading was slow and considerable distortion of the disc was experienced. The non-magnetic character of the alloy precluded the use of a magnetic chuck. Other conventional types of holding fixtures failed.

The arbor finally designed is shown in the illustration. Its chief interesting and unusual feature is the use of hard rubber blocks to grip the workpiece while turning the workpiece.

The sectioned diagram of the arbor shows a flanged plug A, and a flanged hub M as the components to which the rubber discs D and Q respectively are attached. Recesses E in the plug and R in the hub are slightly inclined, about 7°, in the direction indicated, for the purpose of retaining securely the press fitted discs. The OD of that portion of the rubber discs which projects out of the flange, is about ¾" less than the OD of the workpiece X. To insure that the rubber discs were true and parallel, a light skimming cut was taken across their inner faces. With this arrangement of the rubber discs, the workpiece can be gripped on opposite sides and held securely for rim machining.

The hardened and ground steel sleeve F was bored to a close push fit over the ground tailstock spindle G. To prevent the sleeve F from rotating independently on the tailstock spindle, the tee-shaped key H was installed, with a smooth sliding fit, in the keyway I, cut along one side of the spindle to guide it within the bore of the tailstock casting. A soft steel, knurl headed, lock-screw J was threaded through the sleeve wall to lock it tightly on the spindle.

To prevent the sleeve F from pushing back over the spindle G when gripping a workpiece X, the front end of spindle G butts against the squared shoulder at the bottom of the sleeve bore. Two concentric diameters were bored in the opposite end of sleeve F to fit closely over the shank portions, K and L, of the flanged hub M. These fits are close, so that the hub may rotate and slide freely inside the sleeve with a minimum of side play.

A standard type ball-thrust bearing was fitted over the smaller section, L, of the hub shank and against its squared shoulder. Since the hub must rotate and slide freely in the stationary sleeve, the thrust bearing reduces friction between these two parts.

A stiff coil spring O was inserted between the thrust bearing and the step in the sleeve bore. The purpose of it is to force the hub M to its maximum outward position as shown in the diagram. The hub is prevented from passing completely out of the sleeve by the headed check-screw P that is threaded and locked in

the end L of the hub shank. The plain long stalk of the screw passes through a clearance hole bored through the wall between the main bored holes in the sleeve, and the head acts as a positive stop to limit the forward movement of the hub. This screw head is substantially smaller than the conical bore of the tailstock spindle G into which it passes without interference during the operation of the arbor.

To insure concentric mounting of the workpiece, a long hardened steel pilot pin S is provided. This pin is secured in a deep hole bored in the left end of hub M. The long portion of the ⅜" dia pin, projecting beyond the hub flange, fits the center hole pierced through the workpiece X. When the tailstock spindle is advanced to the left for gripping the workpiece, the forward end of the pin S enters the guide hole T bored through the center of flanged plug A mounted in the lathe chuck. The leading end of pin S has a long conical "lead" to facilitate its easy entry into guide hole T.

Mounting the Aluminum Disc

To mount a disc X in position for machining its periphery, the tailstock G is retracted so that the end of pin S is about ¾" clear of the rubber disc D. The workpiece is then slipped over the pin, the tailstock advanced until the workpiece is securely gripped between the two rubber discs, and the shaft of hub M pressed well into the bore of sleeve F.

Chamfering Tool Parts

A	Flanged plug	L	Shank portion of flanged hub
B	Shank of plug	M	Flanged hub
C	Chuck jaws	N	Ball thrust bearing
D	Hard rubber disc	O	Coil spring
E	Recess in flange plug	P	Check screw
F	Steel sleeve	Q	Rubber disc
G	Tailstock spindle	R	Conical recess
H	Tee-shaped key	S	Steel pin
I	Keyway	T	Guide hole
J	Lockscrew	X	Workpiece
K	Shank portion of flanged hub		

When the live spindle of the lathe is started, the flanged hub M and the workpiece X revolve with the flange plug A held in the lathe chuck.

The side chamfers and rounded crest at the periphery of the workpiece are developed by a single pass of a simple form tool mounted on the cross-slide. A fixed stop controls the depth of cut to insure the accuracy of the finished OD of the workpiece.

The large surface area of the rubber discs in contact with the workpiece X, imparts a powerful gripping pressure on the work. The alloy disc is not distorted, since the rubber discs readily adjust themselves to any slight unevenness occurring on the workpiece surface.

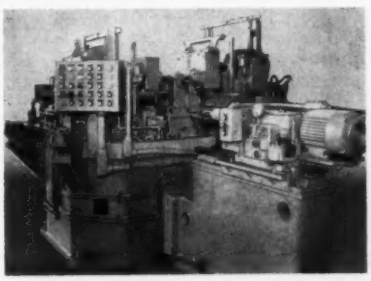
end

THREE-WAY MACHINE FEATURES SPECIAL DRILL HEAD UNIT

The front section cross members of automobile frame assemblies are drilled to exact accuracies on a new three-way Natco machine.

A special horizontal unit with three heads is the most unusual feature of the machine. The outside heads have two stub spindles each pointing toward the center, and the center head has two stub spindles on each side pointing toward the outside heads. All heads have a common mounting and move together, first in one direction to drill the cross members from one side, then in the opposite direction for the opposite holes.

The welded frame assembly comes to the machine by conveyor, and the machine hydraulically lowers the part and clamps it into position. At the start of the drilling cycle, two two-spindle drilling units come in from each side to combination drill and ream two 9/16" dia holes in the sides of the frame. At the same time, the multi-head moves at right

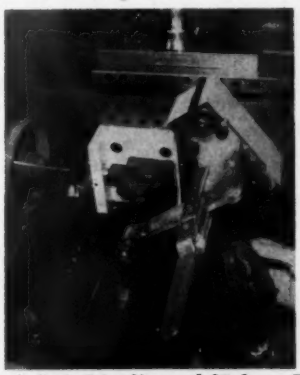


angles to drill, ream and chamfer four ⅞" holes in the cross members from one direction, then reverses its direction to perform identical operations on the opposite sides of the cross members. Accuracy has to be such that a rod, 0.010" undersize, can be passed through holes in both cross members freely.

On return of the heads to start position, the part is unclamped and elevated to the level of the conveyor. Machine cycle time is approximately 60 sec for all operations. The machine was built by National Automatic Tool Company, Inc.

SWITCH IN METHODS ELIMINATES OPERATIONS

Two operations were eliminated by switching from the conventional method of drilling a cast iron valve control housing to one employing the Starbore drill pictured here. The



hole is 0.436" in dia, and 6" deep. The drill is tipped with Carmet type CA-4 carbide and it drills the hole in 24 sec. Accuracy is held to 0.0005" and surface finish is 20 micro-inches. Speed is 3,000 rpm and coolant pressure, 250 psi.

M. W. Maddox

R. E. Carruth

Don Burkhart

Scientific Management and PRODUCTION AND INVENTORY CONTROL

L. R. Norheimer

by Carol E. Reuss
Associate Editor

GIVEN: Men, machines, materials, and orders.
PROBLEM: Coordinate these to produce the ordered goods most efficiently and economically, and at the time needed.

THAT'S NOT A VERSION OF A BASIC economic theory. It's a simplified description of the complex organizing job necessary in every manufacturing plant before and during the production of any product.

The task of coordinating all the individual factors involved in production falls upon the shoulders of a group of specialists who have been applying their skills for years, but who only recently started to band together to compare notes and exchange ideas as the American Production & Inventory Control Society.

As manufacturing costs have risen and orders have become more competitively placed, top management has become aware of the value of the scientific approach to such managerial problems as how orders and production may best be scheduled for the greatest economy. A company producing small items like fasteners, for instance, can easily lose its competitive position within its field if excessive inventories are allowed to accumulate, orders are scheduled catch-as-catch-can, and machines are allowed to stand idle because of mismatched production sequencing. In times like today, when design and redesign are industry's bywords, a spokesman for an Eastern fastener manufacturer explains, production and inventory management becomes extremely important as a means of guarding against over-production and overflowing inventories, not to mention machine and tool use. "This is where a business can win or lose," he warns, "particularly when they are sub-contractors or component manufacturers."

Taking the scientific approach, raw material inventory is large enough to cover needs for, say, the next 30 days, if that is what the company's records and experience show is a reasonable length of time. Jobs are scheduled for the machines most suited for the particular operations, and different jobs are arranged to arrive and leave a machine in an almost continuous flow, in an effort to get maximum use out of the machine. In addition, any other components needed for a particular job are made ready for the exact time ordered, and any and all orders are traceable in minutes, if need be.

Areas of responsibilities for production and inventory control personnel vary according to size and type of plant. The production control manager for a manufacturer of welding and

. . . Continued on page 104

APIC's First Officers

These four men, who served as pro-tem officers of the new American Production & Inventory Control Society since its inception last year, took over their duties as the first elected officers during the APICS charter meeting in Cleveland in October:

APICS President M. W. (Ron) Maddox was production control manager at Mueller Brass Company, is now associated with the Manufacturing Services staff of Raytheon Manufacturing Company and is conference leader at production and invenotry control seminars conducted by the National Institute of Management, charter member of the Institute of Management Sciences, and a member of the Society for Advancement of Management.

R. E. Carruth, APICS vice president, is production control manager at Acushnet Process Company, and vice president of the New Bedford (Mass.) Production Control Association, the first organized APICS local chapter.

APICS Secretary Don Burkhart is production control manager at Haynes Stellite Company and a member of the Society for Advancement of Management.

Louis R. Norheimer, APICS treasurer, is production control manager at Tube Turns, a division of National Cylinder Gas Company, a charter member and organizer of the American Materials Handling Society, and formerly local chapter president and national regional vice president of the group, for which he was honored for distinguished service to the society.

A TOOLING & PRODUCTION SPECIAL REPORT:

THE DOLLARS AND SENSE OF NUMERICAL CONTROL FOR *YOUR* PLANT---Large or Small

by G. MacF. Tuttle
Assistant Editor

EARLY THIS YEAR IT BECAME EVIDENT that the field of numerical control had entered or was about to enter that period of "new product" development where its application to American manufacture had to be revealed, questioned, and resolved. This educational process is necessary, as we all realize, to enable any new process to pull itself over that inevitable hump of indecision on the part of the potential user. Numerical control, however, has worries in addition to the traditional ones — the small shop "price ogre" of the electronic computer and controls, and the improper balance of past and present publicity toward the very expensive and unique concepts of the computer system.

As research progressed, many important points that were still hazy to general manufacturing view became clear, and above all, proved themselves important to the present and future planning of the independent manufacturer.

Numerical Control and Automation

Numerical control is basically a control concept adaptable to a specific machine tool and should *not* be confused with automation, as such. The human reaction or desire to integrate something new into the scheme of present satisfactory and profitable methods may lead many inquiring minds astray. The idea of bringing numerical control directly to the automation line must not be considered as the true perspective or proper adaptation of the system.

It is a matter of fact that numerical control's purpose lies *under* mass production in quantity, and must not be placed into competition with multiple-tool special purpose setups. Be reminded, however, that between 55% and 65% of United States production is "job-lot" and not "mass", and for that reason alone, numerical control's potential is very great—if not dynamic.

Benefits to be realized through its adoption in an arbitrary shop situation include: First, a great reduction in "human error" and labor problems — greater accuracy, fewer inspections, negligible scrap, and a definite alleviation of the skilled machine operator shortage. Second, an improvement in time and inventory factors — shorter lead time; shorter set-up time; repeatability; a full 8-hr shift per day per machine with no coffee breaks, lunch, or fatigue time; and lower inventory of tools, blueprints, jigs, templates, etc. (just store the tape). Third, mechanical improvement through constant and correct loading of tools, and extreme versatility.

It has been more than suggested that a stumbling block in the sales promotion of numerical control in the independent parts-manufacturing field is the past and present overemphasis on the very complicated and expensive "contour" milling setups that have been designed for the airframe industry, and are just now being placed into service at the time you are reading this article. It cannot be overemphasized that restrict-

ACKNOWLEDGMENTS

WE TAKE THIS OPPORTUNITY to thank the following manufacturers and societies for their assistance in the preparation of this article. Their help, whether by personal interview or written, was sincerely appreciated.

CLASS I
Allison Equipment Company
American Institute of Electrical Engineers
American Society of Mechanical Engineers
Barnes Drill Company
Barnes Engineering Company
General Electric Company
Jones & Lamson Machine Company
Kaukauna Machine & Foundry Division
Modern Engineering Service
Pratt & Whitney Company, Inc.
Westinghouse Electric Corporation

CLASS II
Aircraft Industries Association
Autonetics Div., North American Aviation
Bendix Aviation Corporation
Cincinnati Milling Machine Company
Electronic Control Systems, Inc.
Giddings & Lewis Machine Tool Company
Hughes Tool Company, Aircraft Div.
Kearney & Trecker Corporation
Lockheed Aircraft Corporation
The Martin Company
National Advisory Committee for Aeronautics
Republic Aviation Corporation

GENERAL
American Standards Association
Association for Computing Machinery
Boeing Airplane Company
Buick Motor Division, G.M.C.
Chevrolet Motor Division, G.M.C.
Electronic Industries Association
Fellows Gear Shaper Company
Institute of Radio Engineers
Massachusetts Institute of Technology
Minnesota Mining & Mfg. Co.
National Machine Tool Builders Assoc.
Sperry Gyroscope Company
Stromberg-Carlson Company
Thompson Products, Inc.
Warner & Swasey Corporation

THE INEVITABLE EXCEPTION

A good example of the automation exception that proves the rule is the possibility of a basic machine tool equipped with numerical control proving to be a "poor man's automation" in and by itself. The concept of a small machine shop with its own numerically controlled machine set up to accept job-lot work from a larger firm is food for one's imagination—especially in the light of the control tape being sent along with the order to be retained for future re-orders.

ing all industries' thoughts of numerical control to this type of machine is definitely retarding the progress of numerical control into the field.

The truth or correct outlook lies in the realization that there are two definite types of numerical control which we shall refer to as Class I "Positioning" (sometimes called discrete, end-point, or digital) and Class II "Contouring" (sometimes referred to as continuous-path or profiling)—the latter being the epitome of tape controlled machinery in both use and cost.

It is at this point that perhaps our editorial comment can be of its greatest service, for the cost and application of Class I and Class II are quite different, and the potential use of Class I to the independent manufacturer is close to phenomenal.

Class I "Positioning"

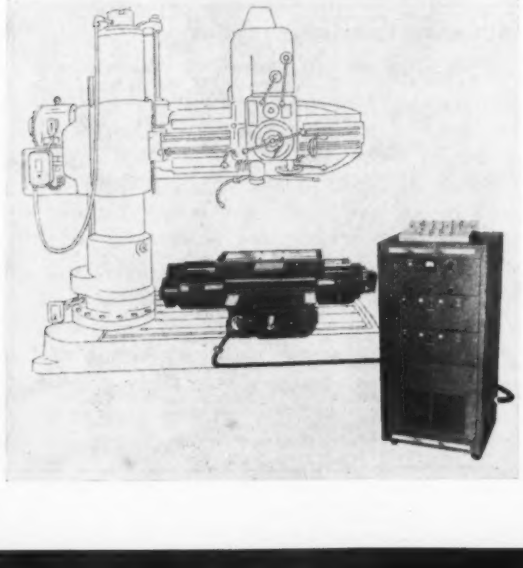
Class I numerical control will be the most widely accepted and used, as its "positioning" system is the most applicable to the general job-lot shop. A basic description would picture a drill press whose table movements are controlled automatically (Fig. 1). The table would move by tape control through an electronic control unit, and would adhere to an "absolute" system where each position would be specified from one original base — thus avoiding the building of one mistake upon the other. Most of these machines can be manual as well as tape controlled and require the operator to press a button before the table indexes to the next position. This would allow tool size, speed, and feed to be changed between drilling operations if desired, and tolerances would be held to within 0.001".

The adaptability of Class I to other definite point-type work should be seen very quickly, e.g., spot facing, chamfering, trepanning, reaming, tapping, boring, riveting, stapling, punching, dimpling, spot and stud welding, and jig boring and grinding.

The progression from an automatic table to a combination automatic table and drilling head represents the step from semi to fully automatic operation. This and automatic tool changing have been accomplished in numerical control. The validity of the final step—tape control of an entire line—has yet to be proven, although it is being attempted.

It has been estimated that whether one piece or 50, a saving of 30% to 50% is within reason over standard machining control methods. This specific percentage example was checked on three installations involving both toolroom and production work.

With this potential so evident, it may be somewhat strange to many people why the automotive manufacturers have not invested. The answer in all probability is relative, not to initial cost, but to the overall economic picture. For example, a relatively new, expensive, and highly automatic plant producing at a very satisfactory mass production rate represents an investment and facility that tends to preclude any aggressive effort to find applications for numerical control. And again, the lack of publicity about the somewhat unglamourous Class I numerical control in its true light may be delaying its progress.



Courtesy, Allison Equipment Co.

Fig. 1. Adaptation of a numerically controlled positioning table to a presently owned machine.

Courtesy, Modern Engineering Service

Fig. 2. Rotary positioning table for numerical control adaptation to presently owned equipment.

Inevitably, Class I will enter the automotive field—certainly in those departments making service parts for past models, and in the low production prototype and experimental department.

It is interesting to note that numerical control shows potential in supplying our automated mass production lines with dies, jigs, and related tooling. Their close but separate application is best shown by an example: Assume that a firm is producing a new water pump housing for their limited-production engine, and around the flange of the housing eight holes must be drilled within certain tolerances. If the housing design is satisfactory and if it is planned to manufacture the same basic engine block for a few years, then it would be good planning to purchase a multiple drill-head for that specific job. However, *if* the engine were scheduled for very early engineering changes that involved the water pump housing, then the use of a tape controlled single-spindle drill press may be the better economical choice.

The most definite use of numerical control in the above example would be the drilling of the housing when the model was several years old, and 50 to 1000 pcs might be needed as replacement parts. Remember, all you would need would be your numerically controlled drilling machine, the workpieces from the foundry, and the control tape and process sheet from the files — no blueprints, no lead or setup time, no shut down.

"Programming" requirements (getting everything ready for the actual machining) for Class I can involve a $200, or less, portable tape punching tool that is small enough to be held in one hand, very little training if any necessary, and a 30 min time expenditure.

In Figure 3 the positions of the desired holes in a workpiece are located by rectangular coordinates identified as "X" and "Y". The plus or minus "X" on a longitudinal line, and the plus or minus "Y" in front of or behind "point zero" are determined, and their coordinates are interpolated and punched in the tape by a punching tool. The "X axis" and "Y axis" are located by using prefinished edges of the workpiece, and "point zero" can be established at any convenient location on the workpiece.

Simple mathematics will convert the conventional "end-point" dimensioning to the coordinate system shown in Figure 3; but, if the general shop use of numerically controlled machines takes place, as we believe it will, then drawings in all probability will change to the coordinate system. This, of course, will be true if the existence of a mechanical drawing is necessary at all. There will always be some form of picture for the records and/or communication purposes, but in the field of numerically controlled machines or computers, the use of a drawing as we know it is being seriously questioned by some authorities in this field.

Careful shopping before final purchase is still important. This is more true in the present early stage of numerical control development, for although actual and proposed competition is keen among its manufacturers, the standards and systems available are quite varied. For example, one system may use a very simple coded tape production system, while another will need a methods engineer and the use of a binary conversion book. The decision rests with the particular needs of the shop in question.

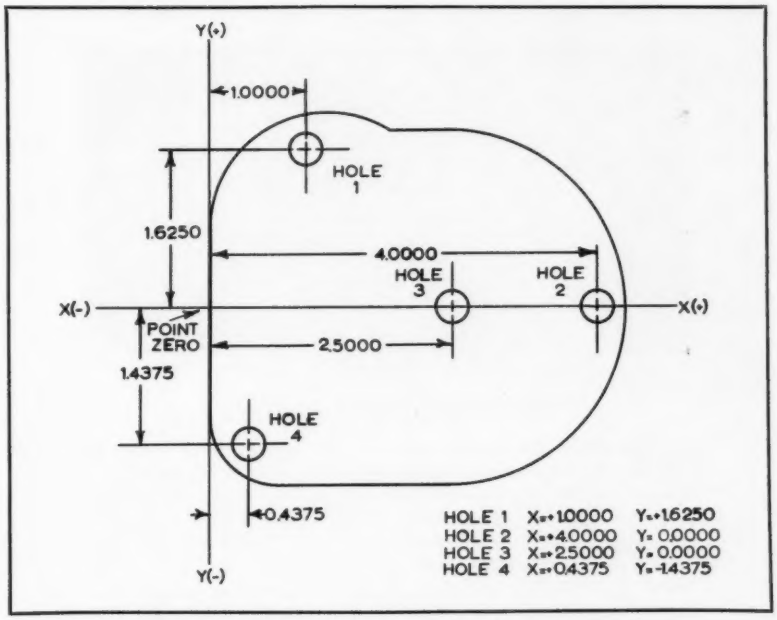
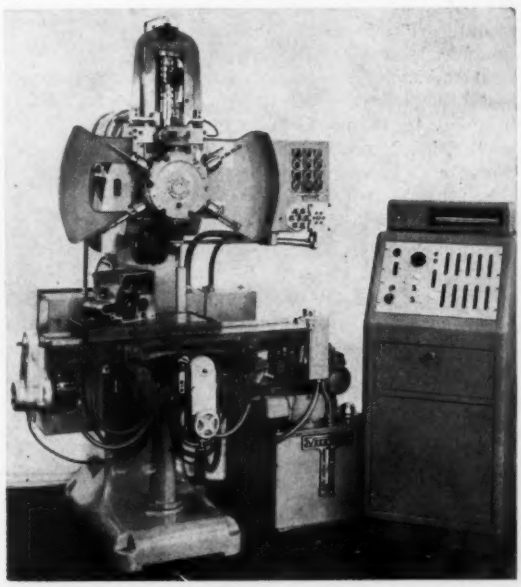


Fig. 3. Location of holes by rectangular coordinates.

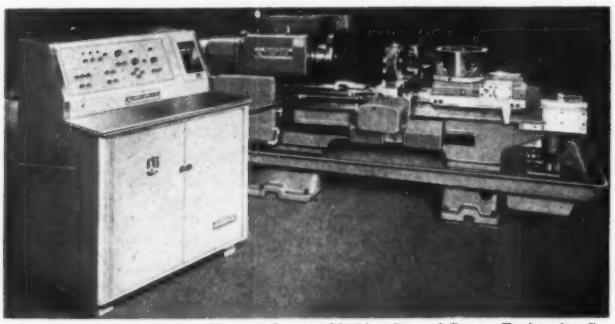
You will note in Figure 1 that the tape controlled positioning-table has been adapted to a radial drill press. There are two points that should be clarified concerning this arrangement: First, the basic "radial" movement of the drill press would be temporarily lost to the shop, for the boom would have to be secured to allow the positive micro-positioning action of the new table. Second, the manufacturers of numerical control components are striving to produce an integration of both machine tool and electronic controls in a single unit.

There is no reason to assume, however, that equipping a presently owned machine tool with numerical control does not have merit. As further evidence of this, Figure 2 shows a rotary indexing table that can be numerical or manual controlled, and permits infinite resolution from 1 to 21,600 divisions of a circle. This positioning table, with its repetitive indices accurate to within one second of an arc, was announced as late as October of this year. In addition, the positioning table that sells for about $9,460 shown in Figure 1 is adaptable



Courtesy, Burg Tool Manufacturing Co., Inc.

Fig. 4. Automatic turret drill and positioning table integration that provides for completely automatic machine operation.



Courtesy, Jones & Lamson Machine Co. and Barnes Engineering Co.

THE LINEAR-PATH VARIETY

Somewhere between Class I "positioning" and Class II "contouring" lies a definite variety of numerical control that has a touch of both systems. It is best described as a "linear-path" or "point-to-point" variety in which a tape controlled tool would enter a workpiece at a definite point (Class I) and cut its way in a straight line to another point (Class II). The latter part of that statement may seem confusing until you reflect that Class II is in fact a series of computer-calculated points along a desired curve.

It would be applicable to turret lathes (see above), engine lathes, or end milling. The important thing for the independent manufacturer to remember about this style of numerical control is that its potential in the small shop is as high as the Class I variety.

to other machine tools, and represents the ability to improve existing automatic spindle machines when the tape controlled table is used in conjunction with them.

An example of the trend to bring the machine and control units into an integrated unit is shown in the automatic hydraulic turret drill with tape controlled table shown in Figure 4. This unit provides complete turret and table indexing from the beginning of the job to the end. Its positioning accuracy is the numerically controlled standard of 0.001", and table travel is 10" x 18". The unit sells for about $19,740, including machine and numerical control components.

The concept of bringing together the machine and controls was further exemplified to this editor at the recent ISA Conference in Cleveland, Ohio, where present planning indicated a complete machining unit in which it would be hard to tell where the control ended and the machine began.

One instance that should prove to be a profitable deviation from this planning is in the field of machine tool repair. The old shop "clunker" sent out for a complete overhaul and adapted to numerical control might be returned looking like a different machine, but the profits would flow for both rebuilder and owner.

The initial investment in Class I numerical control is not the excessive amount that most potential buyers have been led to believe. We hope the delusion of a multi-thousand dollar electronic computer is overshadowed by the availability of a small hand-operated tape punching device at $200 or less. A basic fact is that Class I numerical control *does not need* a computer.

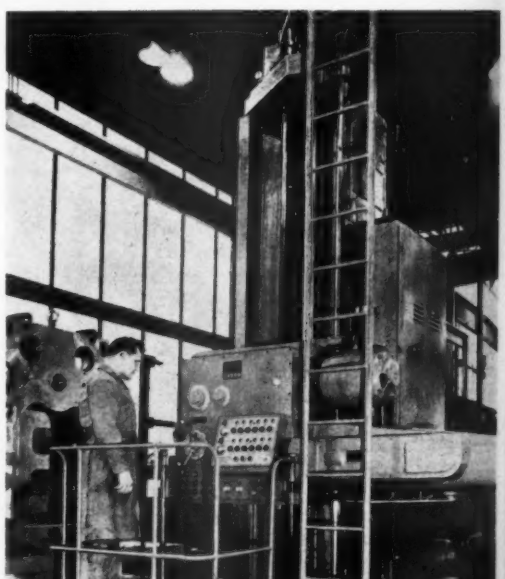
One manufacturer has quoted Class I components for their jig borers at about $13,850. By all standards of potential use, this is not an excessive price.

In Detroit a tool and die shop paid approximately $60,000 for a complete Class I tape controlled machine when the building in which it was placed, along with other equipment, was worth only $25,000. Aside from the spark of adventure and risk, the seeds of belief in a new concept are in evidence here. Another shop in the same area with less than 20 men has made a similar investment.

We were fortunate enough at the time of writing to witness the introduction of another numerically controlled standard type machine tool. This boring mill (Fig. 5) is aimed at the general metalworking industry and represents one of the most recent applications of positioning type control from pre-calculated data. It can be operated manually, by digital dial control, or by punched tape.

Programming the tape for this machine is representative of the technique used generally (Fig. 9) and includes the following procedure:

1. A process man prepares a step-by-step process sheet from a drawing.



Courtesy, Kaukauna Machine & Foundry Div., Giddings & Lewis.

Fig. 5. A 5" spindle boring mill with manual, digital-dial, and tape control.

2. The process sheet is typed on a special typewriter (Fig. 6) that makes a punched tape at the same time.

3. The tape is placed into the control unit of the machine (Fig. 7) and the operator is given the process sheet to facilitate tool changes.

This 5" spindle, floor type, horizontal boring, milling, and drilling machine with rotating table and numerical control components will sell for about $90,000. It is available with automatic indexing, and positioning accuracy is being held better than 0.001" based on a glass scale measuring system.

In the present field of precision toolroom equipment is the jig borer shown in Figure 8. Here the data contained in the tape controls the two-dimensional positioning of the table to an accuracy of ±0.0001".

In this application numerical control will be especially helpful in the manufacture of a single piece of considerable complexity. This is based on the standard jig boring technique that requires all holes to be spotted one at a time, drilled, then rough bored, and finally finish bored. This series of settings may have to be made four to six times to produce a single piece. With tape control this repetitive setting is unnecessary.

The jig boring machine in Figure 8 with numerical control sells for about $60,000. It may be used for inspection purposes, a rotary table is obtainable, and future plans call for tape controlled feeds and speeds. It is not too absurd to venture that numerical control may move highly precisioned jig boring and jig grinding out of the toolroom and into modified production operations even more than it is now.

Two papers obtainable on tape controlled jig boring are:

- "A Numerically Controlled Jig Borer" — ASTE No. 24T12
- "Precise Positioning with Numerical Control" — AIEE

The implication and overall simplicity of operation of the Class I numerical controlled machines must not be pushed aside regardless of price in your planning for the future. Whoever said, "The man who needs a new machine tool is already paying for it" could not have applied his words to a better instance. Above all, if there is a possibility of Class I numerical control fitting into your scheme of operation, get the facts now. The much joked about "one man shop" may be far from humorous if you are not the "man."

Courtesy, Commercial Controls Corporation

Fig. 6. Simultaneous production of process sheet and tape on a Flexowriter.

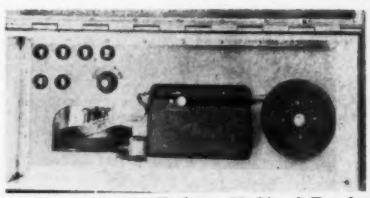
Class II "Contouring"

By glancing at the general outline of the programming steps in Figure 10 you will note that the main difference in a contouring operation is the addition of a computer and its associated coding.

Even at this early stage in the application of numerical control to general industry, the necessity for certain standards of operation and nomenclature has been felt. For that reason the outlines shown in Figures 9 and 10 for positioning and contouring operations are very general. The reader, however, may feel assured that the steps and names shown may be used as a basis for understanding the various systems and titles in existence. As an example of the standards problem, our research brought out the case of a company that wanted numerical control but company policy would not permit the purchase of another computer — so the manufacturer called its computer unit by a different name and closed the sale.

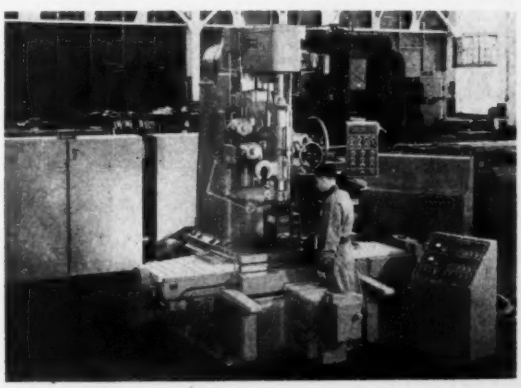
Of the two main classifications of numerical control, the Class II "contouring" system will be the hardest to apply to the automotive or general metalworking field. Two prime factors are causing the trouble: the high initial cost, and where to apply it outside the airframe industry.

An example of the application problem can be seen in what should be a definite use for Class II in the automotive field — die sinking. As explained to this editor, the very important ability of numercial control to reduce lead time may be retarded in the automotive business by the philosophy of *style* over *function*. Most style conscious automobile designers do not follow a mathematical progression that could be quickly computed for three-dimensional milling. The functional necessity of aircraft design provided the initial welcome given to the Class II machines shown in Figures 16 and 17, and it is in that field that they have seen their greatest potential. As one engineer associated with a west coast aviation firm said, "About all we can really style now in an airplane are the knobs on the instrument panel."



Courtesy, Kaukauna Machine & Foundry Division, Giddings & Lewis.

Fig. 7. Installation of tape control unit.



Courtesy, Pratt & Whitney Company, Inc.

Fig. 8. Numerically controlled jig borer.

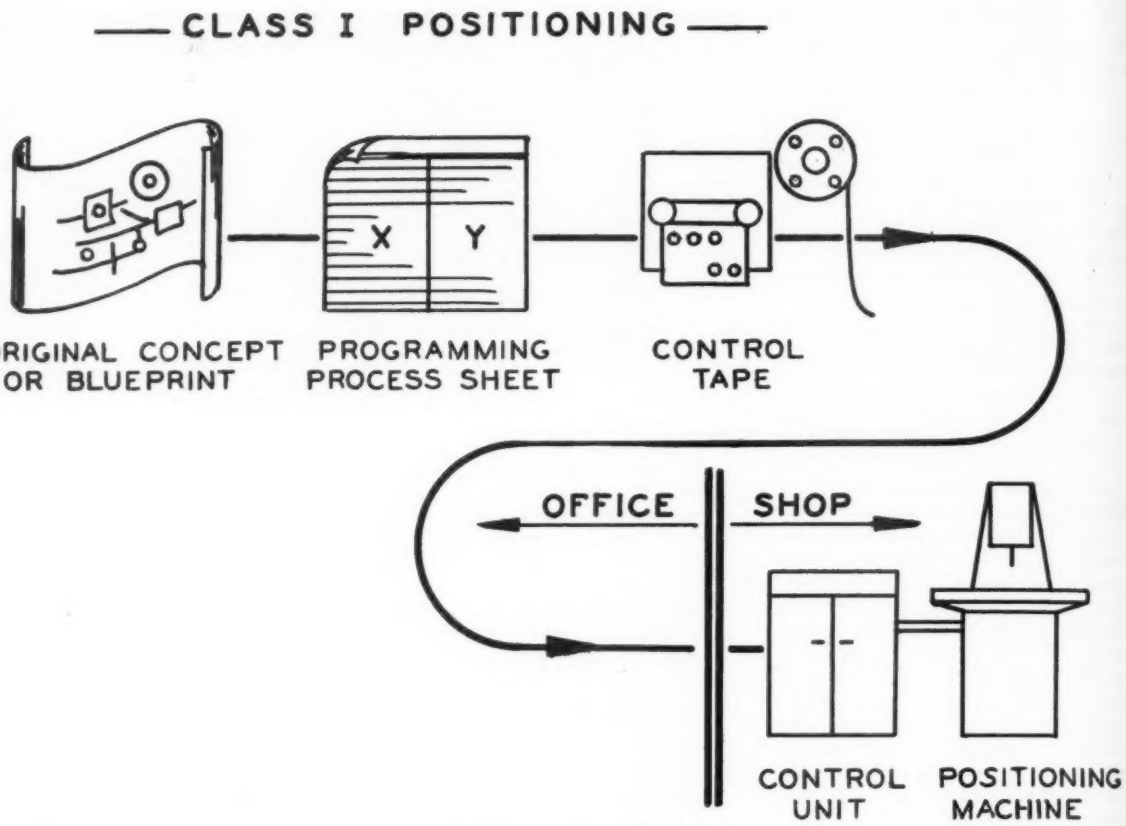


Fig. 9. Programming for positioning.

Contouring

It is important that the concept of contouring be understood, and that it can be interpreted as being two dimensional as well as three dimensional. In Figure 11 workpieces "A" and "B" represent contouring operations as much as the three dimensioned example "C" — although the latter would entail much more machining calculation.

If the rounded end of workpiece "A" were the arc of a definite radius, the calculations necessary would be quickly based on the known radius. However, the irregular end of "B" would necessitate a series of known points (coordinates) from which intermediate points could be interpolated by a computer to produce the desired convolutions.

Computers

As you finished the previous paragraph, you probably had the same feeling that caused the first computer to be designed and built, for these wonderful electronic devices have taken the inherent confusion, routine, and time consuming mental work (such as repetitive mathematics) off the back of the engineer.

The primary purpose of the computer in machining operations will be to plot the necessary additional points along the desired path of the cutter (Fig. 12). This plotting will be based on two sources of information: first, the stored instructions or sub-routines that are previously loaded in the computer and, second, the information pertaining to the present problem. This second bit of data usually consists of the *coordinates* already known on the curve, the type and dimensions of the *cutting tool* to be used, and the *tolerances* allowed between the computed points.

Computers can perform many secondary operations. In a large organization it might prove profitable to load the computer to provide the best feeds and speeds, and which machine to use for an operation. Computations would be based on such data as the kind, thickness, width, and length of the material to be machined.

The computer's ability to search a complete range of possibilities could be adapted to rapidly produce data required for a working print, or information that would insure maximum service. In this respect, one company reports a time savings ratio of 22:1 from order date to delivery date on gear shaper cutters, shaving tools, and master gears (Fig. 13).

As explained in the section on Class I, the manufacturers of numerical control components are striving to integrate the machine and controls into a single unit. For that reason, computers supplied with Class II machines are not only an integrated part of the unit but also represent a *definite-purpose* type of electronic device. Although it may be a futile bit of knowledge to a prospective buyer, it is a known fact around engineering circles that any general accounting office type of computer can handle the job of interpolating points along a curve. There is a way of avoiding the procurement of an additional computer which will be covered in the section on programming.

The electronic defining of a contour as a mathematical curve or production of a table of points along a curve — no matter how you look at

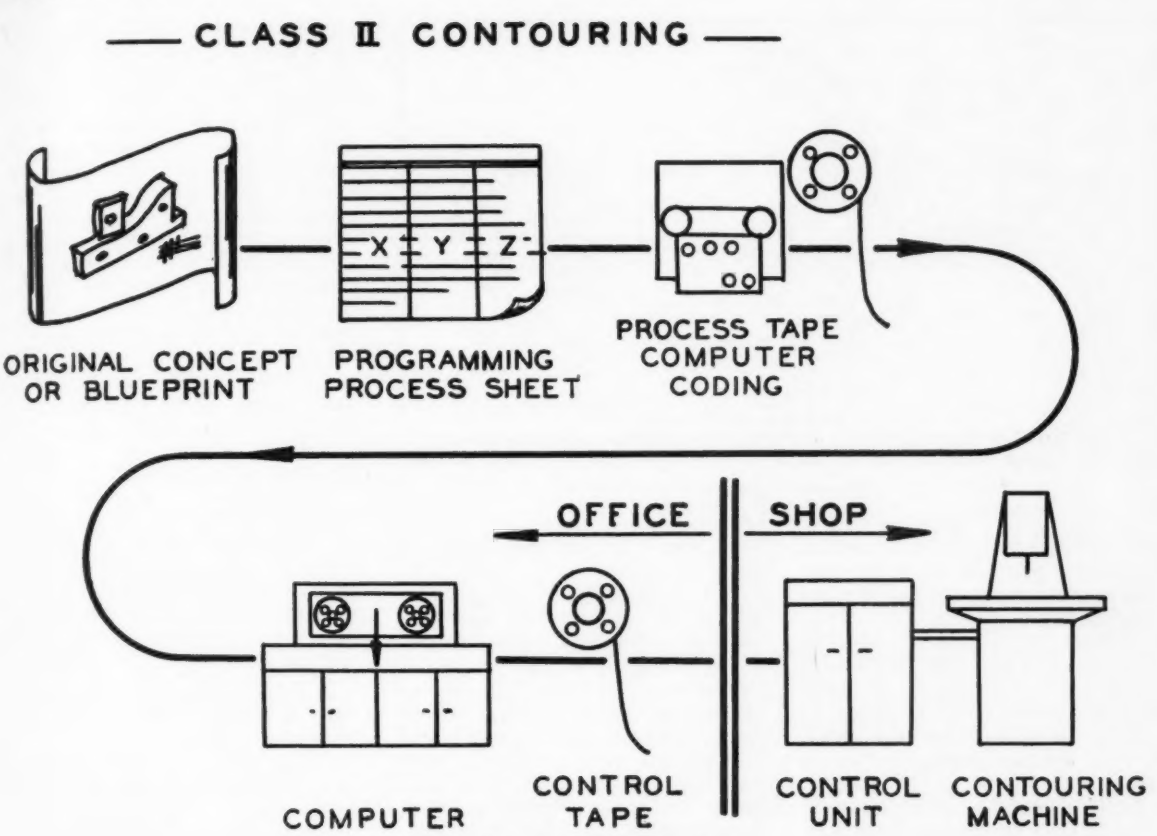


Fig. 10. Programming for contouring.

it — represents a large portion of the investment in a Class II numerical control system. The price of the computer alone could well cover the majority of complete Class I systems — including both machine and controls. Price quotations on computers and related components have ranged from $50,000 to $750,000 with rental option between $50 and $500/hr.

Programming

"In the field of numerical control any machining operation, whether simple or complex, the machining cost from the second workpiece on is practically free, and with proper cost planning the break-even point will range between 2 and 25 pcs."

It does not take profound genius to separate the above statement into its good and bad elements. Industry is willing to accept the good points, but what happens *up to* "the second workpiece" is the factor that has made *programming* a nasty word in the numerical control field. Two factors have come to light during our recent research on programming techniques that should alleviate most of this undeserved feeling.

First, a Class II programming team does *not* have to consist of a methods engineer, a mathematical consultant, a computer coding expert, two or three technicians, and some typists.

Second, a programming service has been initiated by Kearney & Trecker that will prepare control tape from either process tape or a certified process sheet for their KTNC machines, thus alleviating the need for purchase of a computer.

With regard to a programming team, there would be need for a process man to interpret the blueprint (or original idea) and place the necessary information on a process sheet. To show that this is not the complex problem that many believe it to be, it may prove helpful to outline a typical machining progression.

For example, Figure 14 shows a contouring operation on a coordinate type print. In the upper right corner is the table of section points neces-

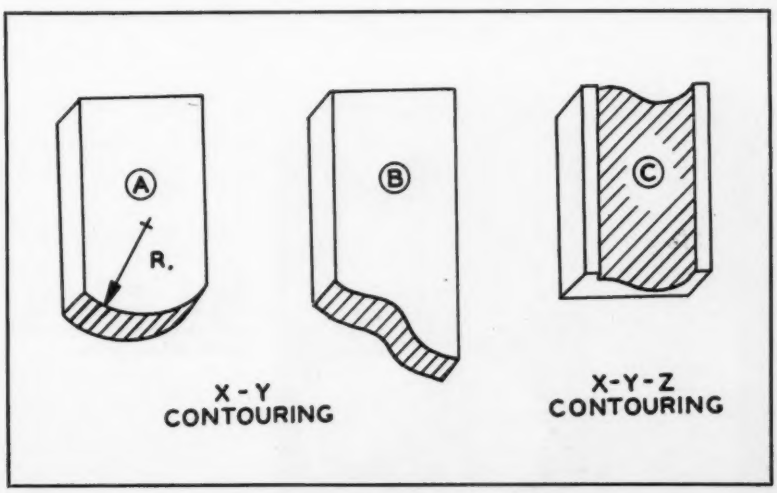


Fig. 11. Basic contouring operations.

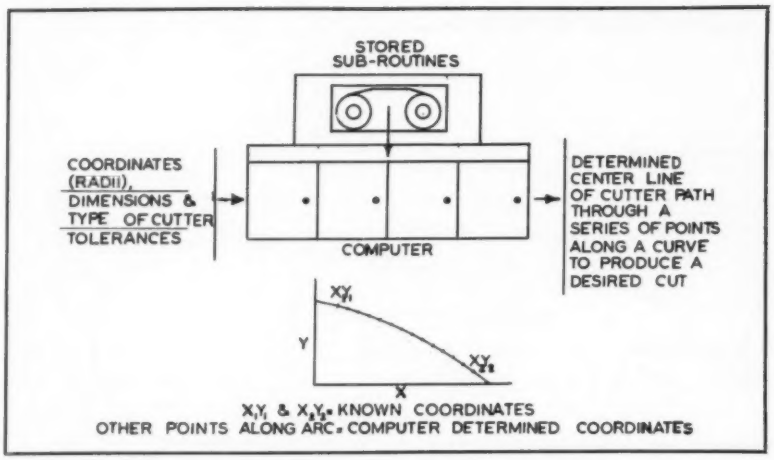


Fig. 12. Use of computer for contouring operations.

sary to define the path of the cutter. The circles represent the 1" dia cutting tool and are shown only for explanatory purposes.

1. Point "A" represents the cutting tool at rest 1.5000" above the bottom of the workpiece at point zero, and 2.0000" above the table.

2. "A'" brings the tool to the work level of the workpiece, but still at point zero.

3. "B" brings the tool to the point of initial cut and machining begins.

4. "C" is where the linear cut stops and the computed arc (convex) of a 1.5000" radius begins.

5. "D" ends the radial cut and begins another linear cut.

6. "E" ends the linear cut.

7. "F" is an arbitrary point to clear the workpiece and permit re-entry at "E" where the second computed (concave) radial cut is begun.

8. The radial cut ends at the initial point of work "B".

9. The tool leaves the workipece at "B" and returns to 1.5000" above the table at "G".

10. From "G" the tool returns to point zero at "A".

The coordinate blueprint information provides the process man with the data to place on the process sheet shown in Figure 15. This part of the programming process is very important in the correct understanding of the over-all contouring operation.

When the process sheet is prepared and ready to be typed and taped, the human element assumes a secondary nature. Serious human error is still possible, however, as a typist's error will also cause an error in the process tape. Concern over this possibility has caused one company to develop a clever quick-check system. This involves a process sheet designed to allow the process man and the typist to use the same sheet. The typed data is placed directly under each written process entry.

Shop conditions are far from conducive to accepted programming technique. The aspect of process or control tape in hands covered with cutting oil, chips, and grime, or the possible flushing down of a $70,000 computing unit with a generous supply of soluble-oil coolant is far from practical. The accepted technique is to separate the numerical control setup into an "office-shop" arrangement in which the programming end would be retained in a special data processing room. Here the tool engineering department would process the job under ideal conditions of cleanliness, temperature, and humidity that are required for computer processing. The production department on the shop floor would receive the results in the form of control tape, process sheet, and perhaps a sketch or drawing for reference. The separation points can be seen in Figures 9 and 10.

The process sheet in Figure 15 corresponds to the drawing in Figure 14. To a technician or process man every column is very important, but the variety of programming styles in use at the present time would indicate our identifying only the main columns.

1. The first three columns are for the X-Y-Z coordinates of the contouring operation.

2. The one marked INITIAL CLEARANCE is ignored if the clearance is greater than the tool radius. It is also used to define the effective tool radius for pocket milling.

3. The CIRCLE RADIUS is marked plus (+) for clockwise and minus (−) for counter-clockwise cutting.

4. In ARC LENGTH: 0 = straight line, 1 = circle arc greater than 180°, and 2 = circle arc less than 180°.

5. In CORNER: 0 = inside corner, 1 = outside corner, and a minus (−) shows a desired automatic slowdown.

6. In TYPE OF POINT: O = index point, 1 = section point XZ, 2 = section point XY plane, 3 = section point YZ plane, and a minus (−) starting section point.

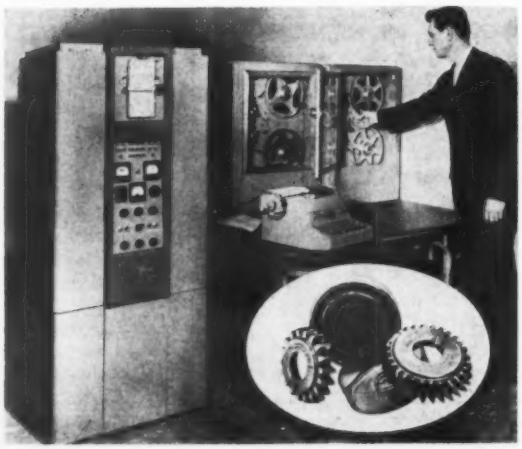
7. The FEED RATE is listed in inches per minute (ipm).

8. The TOOL DIAMETER is listed in inches, and is further identified by a minus (−) if the cut is on the left side of the workpiece (looking in the direction of the cutting) and a blank space if the cut is on the right.

9. In AUX. FUNC. (auxiliary function): 04 = stop code, and 05 = reference mark on the control tape.

10. The FINAL CUT is for a finishing pass, and if a minus (−) is used, material is to be left for later removal.

Numerical control is engineer centered and benefits from this arrangement are many. Of prime importance



Courtesy, Bendix Aviation Corp. and Fellows Gear Shaper Co.

Fig. 13. A G-15 general purpose computer, control typewriter, and two extra storage units.

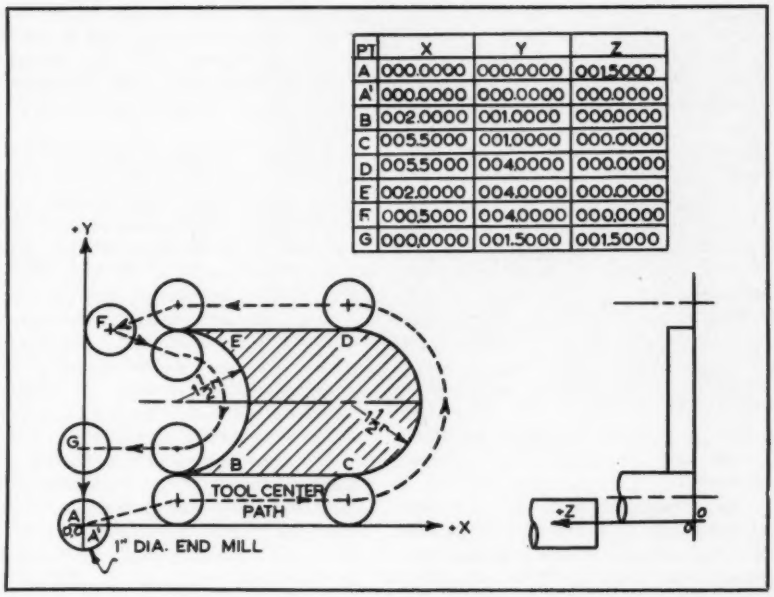
is the placing of the final responsibility on the engineer and not on the machine operator. Another boon leads to the alleviation of skilled operator shortages, and outside the union or closed shop, the operation of several machines by one operator.

We mentioned a second important factor that would assist the general industrial field in the programming of numerical control data; this is the use of someone else's computer for production of control tape. Of great importance here is the removing of the initial computer cost of about $70,000. Even to rent a similar computer would entail about $1,800/mo plus the trained personnel.

One computer company is offering their customers a programming training course on a no-charge basis, but by far the most interesting factor in the "program selling" scheme is the great possibilities for a company that would be organized specifically to program for numerical control owners.

Kearney & Trecker's KTNC tape preparation service was effective October 10th of this year and specifies the following prices which are, of course, subject to change:

A. Service charge — each order to cover processing orders — per order: $50.



Courtesy, Kearney & Trecker Corp.

Fig. 14. A coordinate type blueprint for a contouring operation.

B. Flexowriter service — translation from process sheet to tape: $15/hr.

C. Computer service — production of control tape: $50/hr.

D. Control tape read — coordinate points typed by computer: $50/hr.

Storage Media

The three main types of storage media for machine tool control are perforated tape (paper or plastic), perforated cards, and magnetic tape. Each has a wide range of data handling capability for present control

	SETUP POINT X IN.	SETUP POINT Y IN.	SETUP POINT Z IN.		CLEARANCE PLANE Z_0 IN.	TOLERANCE IN.	TYPE OF APPROX	DATE 10/10/57						PART NO. SAMPLE - KTNC TAPE NO.					
								PLANER R.B.C						SHEET 1 OF 1					
A	000.0000	000.0000	001.5000	/	002.0000	000.0001	1												
	END POINT OF MOTION X IN.	END POINT OF MOTION Y IN.	END POINT OF MOTION Z IN.	/	INITIAL CLEARANCE IN.	CIRCLE RADIUS IN.	ARC LENGTH	CORNER	TYPE OF POINT	R 00	FEED RATE IN./MIN.	TOOL DIAM. IN.	R 40	AUX. FUNC.	R 41	FINAL CUT IN.	ROUGH CUT PASSES	NO. OF SECTIONS	R 01
	print																		
	10	45																	
											021.0000	001.0000	40						
														05	41				
A'	000.0000	000.0000	000.0000	/			0	0	0	00									
B	002.0000	001.0000	000.0000	/			0	0	-2	00									
C	005.5000	001.0000	000.0000	/			0	1	2	00									
D	005.5000	004.0000	000.0000	/		-001.5000	1	1	2	00									
E	002.0000	004.0000	000.0000	/			0	0	2	00									
F	000.5000	004.0000	000.0000	/			0	0	0	00									
E	002.0000	004.0000	000.0000	/			0	0	-2	00									
B	002.0000	001.0000	000.0000	/		+001.5000	1	0	2	00									
											030.0000	001.0000	40						
G	000.0000	001.5000	001.5000	/			0	0	0	00									
A	000.0000	000.0000	001.5000	/			0	0	0	00									
	end																		

Courtesy, Kearney & Trecker Corp.

Fig. 15. The process sheet for the coordinate blueprint shown in Figure 14.

equipment, and each has definite advantages.

At the present time, the investor in a numerically controlled machine must rely on the engineering reputation of the machine tool builder. This is true as control mechanisms are very seldom sold to anyone but the manufacturers of the machine that will use them as an integrated part of the complete unit.

The increased necessity for storage density and high information rates required by Class II contouring operations speeded the development of high speed perforated tape and card handling devices. As a result, present electronic pick-up techniques have increased the speed about 20 times over the original mechanical means.

Evaluation of "which is best" definitely must be based on engineering evaluations of the final purpose. The only other feasible deterrent from one system to another would be the case of a concern that already had tape, card, or magnetic equipment and wished to incorporate its use with the new machine.

The AIEE has a rather complete paper on the subject titled "Computer Elements Available for Machine Tool Use."

There are great benefits to be realized no matter which media is used. Low tooling inventory based on storing the tape for future use instead of jigs and fixtures is one example. Another instance is the ability to send duplicate tapes to other plants at any distance for the reproduction of absolutely identical parts — within the limits of the machine used.

In Class I positioning there is a numerical control method that lies between the standard manual electric control and the tape or card numerical control. It is best described as a digital dial control in which the operator sets the dials to locate the next position, presses a button, and the machine goes to the next position automatically. Very often this system has visual electric numbers that light up for checking purposes. By looking carefully at Figure 5 this digital dial control can be seen as two rows of six dark knobs in the lower right section of the main control panel.

Contouring Machines

Two representative Class II numercial control machine units or described in the following paragraphs; however, a much smaller three-axis knee-type milling machine and control unit is on the boards that will sell for about $70,000.

The three-axis horizontal milling machine (Fig. 16) is also for ferrous or non-ferrous metals, and is billed as the forerunner of a line of machine tools designed and built specifically to be operated by numerical control.

This 48" x 168" working-surface miller is available with two separate head options: low — 36 to 1800 rpm, and high — 1800 to 3600 rpm. Feed range is 0" to 100 ipm, and the rapid traverse rate is 36 to 180 ipm. Short feed motion is through recirculating ball screws, and long feed through a double-pinion and rack. Ways are high carbon spring steel against nonmetallic slipper-pads. Feedback racks are pretested to a total error of less than 0.0005" in 168".

The control system is actuated by punched plastic tape, and a visual electronic positioning indicator that reads in 0.0002" increments is available. The machine and control unit as pictured sells in the $250,000 range.

The five-axis contour milling machine (Fig. 17) provides for two extra radial movements as shown in Figure 18. All five motions possible are controlled and synchronized by 14-channel magnetic tape.

The working surface of this machine is 48" x 168", and it will be used in finish milling of complex aluminum forgings for aircraft parts. Due to its present military application, we have found it difficult to pin down a price. This AIA classified Type VI miller will probably cost between $350,000 and $450,000 for control unit and machine. The programming equipment such as the computer for this multi-channel device will represent an extra investment.

Problems

Maintenance of the new electronic controls, whether programming or mechanical, will present the biggest problem to the new owner of a numerical control outfit. The opportunities for technically trained personnel are given another boost in this respect — certainly in the repair, preventive maintenance, and instruction fields.

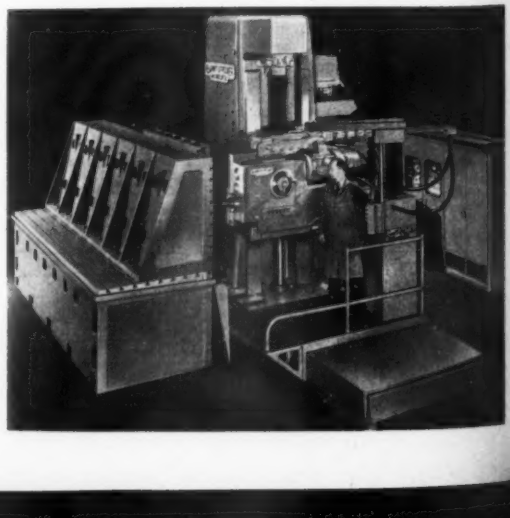
Standards may not be as big a problem as supposed. It is of basic importance, however, that recommendations be suggested that will tend to alleviate any unnecessary control varieties. The reader already knows of the various sizes and types of tape or cards already in use. This fact is intensified by the inability of a control tape to run a milling machine if it were originally prepared for a turret lathe. Again, standards are only useful to the point of practical application. For instance, a simple stylus device for punching the tape would be more applicable to a small shop than a Flexowriter both in cost and use.

Standardization studies in numerical control electronics is very important. This would be especially true in a large firm where several machines of different types could be controlled from one data processing room.

The first punch-tape standard for Industry was recently proposed by the EIA on November 15th. The standard, which is in the approval stage, suggests an all purpose 1" wide tape with a maximum of 8 channels. Several agencies are preparing standards for automatic control, computers, data processing, programming, etc.

Recent papers on numerical control standards include:

- "Standard Dimensional System for Automatic Requirements"—EIA (formerly RETMA).
- "Automatic Control Terminology" — ASME



Courtesy, Kearney & Trecker Corp. and Bendix Aviation Corp.

Fig. 16. A three-dimensional contouring, numerically controlled, horizontal milling machine.

- "Standards on Electronic Computers" — IRE.
- "First Glossary of Programming Terminology" — ACM.
- "Automatic Control Terminology" — ASA.

Tool changing, wear, and breakage are basic carry-overs from standard machining. In the realm of numerical control only tool changing has met with any success. The turret drill in Figure 4 is a good example, and tool changing principles have been adapted to milling machines and jig borers.

The one factor that is in favor of numerical control with regard to tool wear is the job-lot short-run aspect of the system. If wear occurs, a periodic replacement of the tool would probably solve the problem.

Breakage of the tool still remains a headache with automatically controlled machines. How to prevent the unknowing numerical control from forcing a broken tool into the workpiece is one of the problems. Special attendants, audio-detection, special programming, electrical contact, etc. all have drawbacks as well as good points.

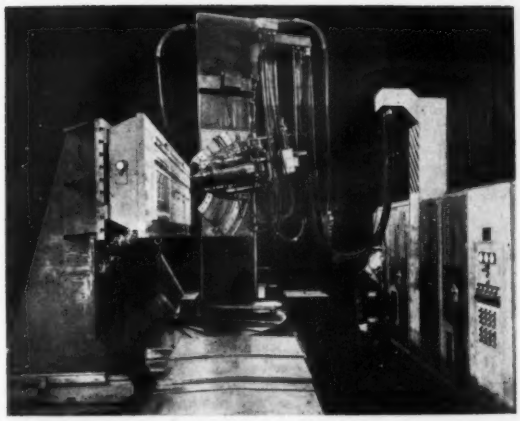
Labor will not take to any concept that reduces manpower, especially if one man can potentially work more than one machine at the same time. The equal pay scale of the worker who apparently has little to do on a numerically controlled miller and one on a labor-demanding standard miller will be a definite problem.

It was interesting to this editor to hear of a special numerical control psychological study made recently. It was deemed necessary by the machine operator's inability to predetermine exactly what the machine was going to do next.

It would seem that the worker trend is still in two directions — away from the middle ground and toward either technical specialty or "chip-carrying" duties. Although the operator of a tape controlled machine may do less physical labor than his buddy on a manual machine, his 8-hr day may seem longer and more boring. This is in contrast with the greater responsibility he assumes on the more complex and more costly machine.

Application and acceptance of Class II numerical control outside the airframe industry may be classified as a problem at this point.

Prototype and experimental contouring of three-dimensional cams, dies, and very intricate workpieces has shown great potential — especially in the reduction of lead time.



Courtesy, Giddings & Lewis Machine Tool Co.

Fig. 17. A 5-axis, contouring, horizontal milling machine classified as Type VI by the AIA.

In general, any contouring operation involving short-run or medium-run quantities of close tolerance, high finish, and intricate design will be directly applicable to numerical control.

Application of numerical control to a specific plant has special problems. Bringing this new concept into a well established processing scheme for materials will require radical changes in operation. These changes would range from the original drawing and through its actual production.

The Martin Company has covered their particular adaptation in a recent paper titled "The Introduction of Numerical Control at Martin" that may prove helpful to management personnel.

Lead Time and Man-Hours

Lead time savings still rank the highest position in the list of benefits to be realized through the use of numerical control for contour mill-

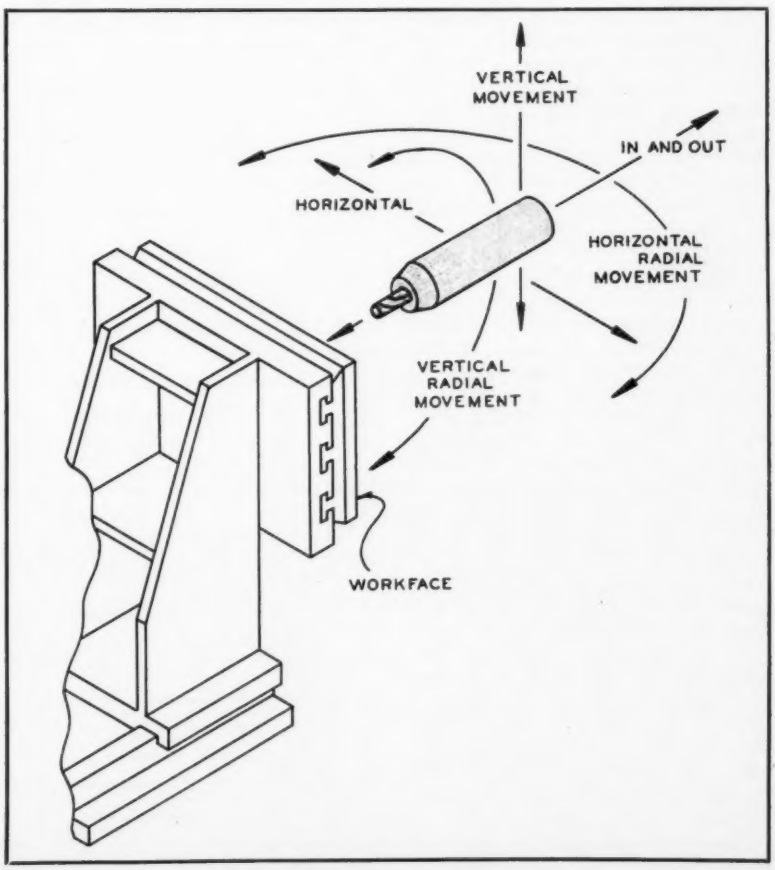


Fig. 18. The two extra radial movements of the milling head shown in Figure 17.

This comparison is based on the manufacture of one part. It considers the following rough and finish machining operations as performed by manual and numerically controlled milling.

1. Boring Large Hole
2. Profile Outside Surface
3. Profile Inside Surface (one side)
4. Profile Inside Surface (other side)

	Manual Control	Numerical Control	
Numerical Machining Drawing	0	30	
Boring Fixture Design	20	0	
Boring Fixture Manufacture	50	0	
Holding Fixture Design	16	23	
Holding Fixture Manufacture	40	48	
Profile Temp Design	24	0	
Profile Temp Manufacture	60	0	
Numerical tape Process Sheet	0	12	
Flexowriter Operator	0	4	
Cost of Flexowriter tape at one tenth of one cent per foot	0	0	15 cents
Computer Operator	0	1	
Cost of Control tape at seven tenths of one cent per foot	0	0	70 cents
Total Tooling Program	210 Hours	118 Hours	
Fixture Set-Up Time (Total)	3-3/4	1	
Machine Run Time (Total)	1-3/4	1	
Includes part set-up Total	5-1/2 Hours	2 Hours	

Courtesy, The Martin Co.

Fig. 19. Step-by-step time comparison between a manual and numerical control milling operation.

ing. In one instance where lead time by conventional methods required over 13 weeks, the tape controlled method ran less than six weeks. A comparison of time saving percentages on this forging die showed a 26% reduction in time between layout and tape preparation, a 55% reduction in machining time, 50% reduction in handwork, and a 75% reduction in inspection. The ratio of 628 to 319 man-hours provided an approximate overall lead time savings of 55%. Comparison savings of 80% or more on lead time are reported on complex aviation dies, molds, forgings, and intricately machined parts.

Another lead time comparison from the aircraft industry concerning master aeleron lines, shows the following statistics: Conventional machining involving plotting coordinates and making a nest of lines, reproducing of contours on template material, and sawing and filing templates involved a total of 240 hrs. Only 60 hrs were involved in the numerical control process-sheet development, tape production, computer run time, and machine run and load time — a ratio of 4 to 1.

A tooling cost comparison has shown a man-hour total of 210 hrs by conventional machining and a total of 118 hrs by numerical control. These figures included the time consumed designing and manufacturing the holding fixture required in this particular tape controlled setup.

Prototype cams that required two to four months lead time have been made in less than one week through a tape controlled milling machine. The machine resembles a small lathe with a high speed ball-end milling cutter instead of a fixed tool.

Actual airfoil or airframe machining can be complicated to the point that an individual machinist would find it next to impossible to produce a reasonable number of workpieces at a profit to his employer. A report from Los Angeles showed a machining time of 90 hrs by conventional milling and only 3 hrs for their numerical control method.

There is an additional notation to be made concerning Figure 19. The first entry titled "Numerical Machining Drawing" represents the changing from a standard drawing to the coordinate type demanded by tape controlled contouring. If the previously discussed future blueprint philosophy comes to pass, then an additional 30 hrs may be removed from the numerical control side of the ledger.

The Future

Whenever the outlook of a new system is ventured, there is the ever present biased or unbiased "personal opinion." Our research has revealed, however, the certainty of two things — first, numerical control is here, it is good, and it shall enter industry on a much greater scale; second, there is great need to educate industry in the truths of the new system.

end

NUMERICAL CONTROL MANUFACTURERS

THIS LIST REPRESENTS to the best of our knowledge the manufacturers definitely in the field at the present time. In some instances the machine manufacturer produces its own control system.

Machines:

Allison Equipment Co., Santa Monica, Cal.
Arter Grinding Machine Co., Worcester, Mass.
Baker Brothers Inc., Toledo, Ohio
Barnes Drill Company, Rockford, Ill.
Cincinnati Milling Machine Company, Cincinnati, Ohio
The Fosdick Machine Tool Co., Cincinnati 23, Ohio
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Machine Company, Madison, Wis.
Hillyer Instrument Co., Inc., New York, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Division, Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Laboratory for Electronics, Boston, Mass.
Modern Engineering Service, Berkley, Mich.
Monarch Machine Tool Co., Sidney, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Machine Tool Co., Rockford, Ill.
Superior Machine & Engineering Co., Detroit, Mich.
Wiedemann Machine Co., Philadelphia, Pa.

Controls:

Autonetics Division of North American Aviation Inc., Los Angeles, Cal.
Barnes Engineering Co., Stamford, Conn.
Bendix Aviation Corporation, Detroit, Mich.
Commercial Controls Corp., Rochester, N. Y.
Concord Control Inc., Boston, Mass.
Electronic Control Systems Inc., Los Angeles, Cal.
Farrand Controls, Inc., New York, N. Y.
General Electric Company, Waynesboro, Va.
International Business Machines Corp., Endicott, N. Y.
The Maico Co. Inc., Minneapolis, Minn.
Minneapolis-Honeywell Regulator Corp., Minneapolis, Minn.
Sperry Gyroscope Co., Division of Sperry Rand Corp., Great Neck, N. Y.
Warner & Swasey Research Corp., New York, N. Y.
Westinghouse Electric Corp., Buffalo, N. Y.

. . . Drawn Stampings from Page 76

the carrier legs at the end of the first draw or prior to redraw are shown in phantom. With the legs of the new type carrier forming an ellipse in the direction of flow, only a minor amount of pressure on the blank is needed to make the carrier legs move. We have not yet finally determined the action of the blank in regard to thin-out; but, on the dies completed, we had very little thin-out in contrast to the double-cut carrier.

Farther along in our experience with this carrier type, we found another point that we hadn't given much thought to; it gave us a very low quantity of slivers from the stock material. Slivers have always been a problem in progressive dies because of the downtime and maintenance they cause. With the double-cut carrier, the carrier legs are driven up between the skeleton and the blank on the first draw, thus creating hundreds of little slivers along the edge of the blank, carrier legs, and scrap skeleton. These slivers work their way through the rest of the die, some dropping off in each station. These must be cleaned out frequently or they will gall up the cutting edges and in general foul up the action of the die. With the scrap-leg carrier, we make our pressure pad with a lip double stock thickness deep and the diameter 0.030″ under the blank diameter. The legs flow right under the pad; the blank is not driven back up into the scrap skeleton.

In the past, the double-leg carrier has restricted our combining of operations — compounding stations as we do in single crack dies. However, the new scrap-leg carrier does give more freedom to improve techniques of compound action in a progressive die. The ability to combine a trim and redraw in the same station on one die we built, saved us 16″ in die length.

If we trim and redraw in the same station on the double-cut, as seen in Figure 5, the carrier legs bind up around the trim punch as the part is redrawn after trimming. To avoid this, we normally build two stations, with an idle station between, to accomplish the same work we can do in a single station with the scrap-leg carrier. You can trim closer on the scrap-leg carrier die; and, as the part is redrawn, the

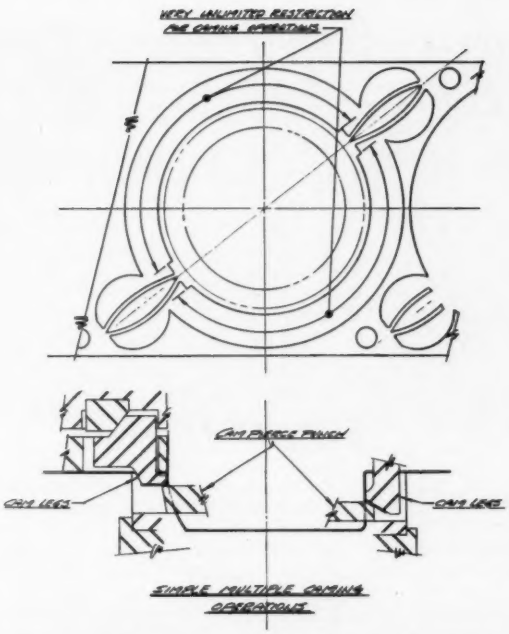


Fig. 6. Strip section showing the broad clearance available for camming operations, when using the scrap-leg carrier.

carrier legs collapse away from the trim punch, as seen at upper right in Figure 5. With the freedom of movement by this carrier, many more compound actions can be employed to shorten dies and help shorten costs.

We had another problem with the double-cut carrier when it came to cam piercing. On one part we had to pierce five tabs and, regardless of how the part was placed in the strip, we could not come up with a clean design on the cam legs. In contrast, the scrap-leg carrier gave us two clear openings around the part to bring in our cam legs with sufficient strength built into them.

Side cam piercing is always a tough design problem in any high production progressive die. With the openings around the part, as seen in Figure 6, you can simplify the design and get plenty of beef into the working details.

With all the advantages that this type of carrier gives, it might not be a bad idea to give it consideration when you put your next die on the drafting board. This technique might not be suitable for all parts, but it definitely has its place.

end

Coming Soon . . .

"Staking Can Save Money in Assembly"
"The Acceptability of Screw Threads"
Special Report on Diamond Use and Conservation
"Factors in Performance of Coated Abrasives"
"A New Approach to Milling Steel with Carbides"

Automatic Torque Tools Help Caterpillar Build its Rugged Earthmovers

Quality Control Improved on Dozen Jobs with Air Powered Torsion Bar Impactools

QUALITY CONTROL has been improved by Caterpillar Tractor Co. on a dozen operations by introduction of automatic torque control impact wrenches for assembly of rugged earthmoving equipment at Joliet, Illinois.

Probably no equipment takes harder wear than the big scrapers, rippers and other earthmovers that help build the nation's highways. Contractors work against the calendar and necessarily work their tools to capacity. Caterpillar's design engineers build in the strength for the expected arduous service, but it is equally important to see that assembly specifications are met. Bolts and cap screws must be tightened to specified torque to insure satisfactory performance in the field.

To achieve the desired quality control, Caterpillar assigned more than a dozen assembly jobs to the new Size 5040T Ingersoll-Rand torsion bar torque control Impactool, an air wrench that can be set to a specified torque and shuts off automatically when it reaches that torque. The first tools went into service on March 16th, 1956, less than three months after the new Impactool was announced, and experience with the initial equipment led to the assignment of additional jobs to the same type tools.

The torque control Impactools are used in three departments—on cable control units, on scrapers, and on hydraulic controls. Torque settings range from 14 to 80 ft-lbs. For the lower range, the 5¼-lb tool is equipped with a light torsion bar having capacity up to 60 ft-lbs. Higher torque is obtained with a heavy torsion bar having a 90 ft-lb capacity.

On four of the five cable control assembly jobs, torque is set at 75 ft-lbs, near the high limit of the specifications. In running 12 half-inch bolts to hold the cover to the cable control unit, the consistently high torque insures close fit of the big cover. Another 12 bolts at 75 ft-lbs hold the heavy gear case to the cable control case. Where shim stock is used, it has been found desirable to keep torque on the high side to insure good fit-up. This is the case with the gear case retainer plate where both shim stock and gasket material are used and the four ½" cap screws are run to 75 ft-lbs to provide a good seal and close fit.

On sheave assembly, two ½" cap screws hold the sheave in place in the shroud. The 75 ft-lb torque compensates for the springy metal of the shroud and insures a free-turning sheave. Four ¼" cap screws, run to 14 ft-lbs, hold the retainer plate on the cable control brake. There is shim stock under the plate and again the torque setting is near the high limit of the specifications.

The steering valve assembly is typical of the tool's applications in the hydraulic control department. On this job, seven ½" cap screws are run to 65 ft-lbs. Here we are dealing with a metal-to-metal assembly of precision parts, and torque setting need not be as high to achieve proper fit.

There are varied jobs for the pneumatic torque control tools on the scraper assembly line. Seven ½" cap screws hold a long guide bar inside a cylindrical section of the big draft frame, and an 80 ft-lb torque setting is used because of the heavy job and the springy metal. In assembling the ejector roller, four ⅜" cap screws hold the cap on and 40 ft-lbs is sufficient for a snug metal-to-metal fit. Installing the ejector roller retaining plates is something else again. First, shims are used and, second, the power tool actually helps to pull the tight-fitting assembly into place. For this job the four ½" cap screws are run to 75 ft-lbs.

The wheel retainer assembly involves other problems. There are two sizes with different cap screws and different torque specifications. One tool set at 60 ft-lbs is used to run 7/16" cap screws and another at 40 ft-lbs handles the ⅜" cap screws. In both cases fiber gaskets are used and Caterpillar engineers found that the gaskets settle a little after the screw has been run, thus reducing the tension on the fastener. To insure a residual tension up to specifications, the Impactools are set about 10 ft-lbs higher than the required torque. The same situation exists with the hub cap, held in place with four 7/16" cap screws. Because of the fiber gasket, the power tool is set at 60 ft-lbs, about 10 ft-lbs above the specified torque.

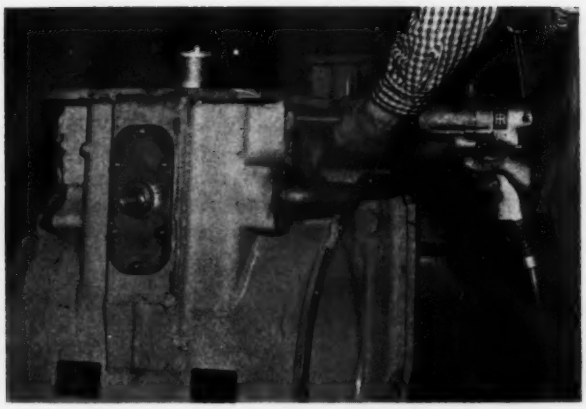
As indicated, torque setting is influenced not only by the desired fastener tension but also by the materials used and the nature of the job. The use of shims or gaskets, the type and thread of bolt or cap screw, the spring in the bolted part, all affect the torque required to achieve a tight, secure assembly. As a result, Caterpillar engineers have each torque control tool set **on the job.** This is done by the pneumatic tool maintenance department, using a simple jig to adjust the twist in the torsion bar which controls the shut-off valve. Sometimes, in introducing a tool to a new job, the torque setting is changed two or three times until the best level is determined. Once set, however, it runs units by the thousands without need for further adjustment. The original tools, in service close to a year, continue to do their jobs without change of torque setting.

The results of Caterpillar's experience with the new torque control air tools at Joliet can be summarized briefly. First, and most important, the engineers report that their tests show every single nut and cap screw meets torque specifications. This is a significant gain in quality control, the basic purpose in introducing the tools.

Since the operator of the new tool lets it run till it shuts itself off, not only is product quality more consistent but the job of training personnel is simplified. Also, the men are glad to be relieved of the responsibility of estimating torque.

The end result is dependable performance in the field—rugged Caterpillar scrapers, moving as much as 34 cu yds of earth in a single haul.

1. An Ingersoll-Rand 5040T torque control Impactool, set at 75 ft-lbs, is used to bolt the cover on a cable control unit at Caterpillar's Joliet plant.



4. Four ½" cap screws are run to 75 ft-lb torque by a torque control Impactool to assemble the gear case retainer plate. Shim stock and gasket material are used and high torque is essential to a good seal.

2. Set at 75 ft-lbs, this Torsion Bar Impactool runs ½" cap screws to hold the sheave steady and free-running in the shroud. The tools shut off automatically when they reach the pre-set torque.

5. The torque control Impactool is set at 75 ft-lbs to run four ½" cap screws to install the ejector roller retainer plate. The tool often helps pull the snug assembly into place.

3. Another 5040T runs 12 nuts to 75 ft-lb torque to assemble the gear case to the cable control case. Once set, the tool continues to run thousands of units to the same pre-determined torque.

6. This I-R Impactool is set at 60 ft-lbs to run four 7/16" cap screws holding the hub cap and its fiber gasket. Since tool shuts off automatically at pre-set torque, personnel training is simplified. end

. . . Management from Page 88

cutting apparatus told TOOLING & PRODUCTION at the APICS charter meeting that his job is "to translate sales forecasts into a master schedule, set inventory policy at levels other than finished product, control material and parts ordering, schedule manufacturing, and see to it that these are executed."

Other production and inventory control people surveyed have their fingers in the purchasing pie, as well as shipping, materials handling, packaging, traffic, and personnel. Naturally, the number and degree of these varied job responsibilities depends a great deal on the size and type of industry and the individual firm's policies.

The size of the production control, inventory control, or combined production-inventory control departments vary also according to plant size and product line. One well-established production control specialist says the average ratio of production-inventory control people to production workers is about 1:20. He believes that advancements in production are likely to change this to one for every 12 production workers. Highly automated plants, for instance, will need a higher ratio of production-inventory control to production workers.

Of the APICS charter members whose titles are specifically "production manager," almost 45% report directly to top production management and almost 35% report to plant management. The rest are directly responsible to various operational management people, or to engineering or purchasing officers. A special survey of TOOLING & PRODUCTION readers gives added weight to that report that manufacturing management is interested in production and inventory control. For example, 25% of T&P's readers tell us that they are either directly or indirectly responsible for production control; 27% are responsible for production planning; and 26% are responsible for production scheduling. Inventory management is a direct or indirect responsibility of 21% of the readers replying to the survey.

Routines vary with different companies, but a typical production and inventory control program for a new order would follow this pattern: Orders are analyzed as received by the production and inventory control specialists. The necessary people or departments in the plant are notified of approximately what to expect in the line of work connected with the order. The production control department ascertains when each item of preparation and execution for the order must be prepared. At the same time, they determine the cost of the particular product, and estimate how the manufacturing cost could be reduced or controlled in the different manufacturing areas.

Tools are authorized for the order. Sometimes they have to be designed, ordered, and built for the project. On the other hand, perhaps the stocked tools will be suitable, or will have to be repaired. If so, this is done in sequence by the production and inventory control specialists.

Inventory control, in the meantime, is busy providing the right quantity of the right kind of raw materials for the products, at the right location and time. All these activities are dispatched and the work performed according to a specified method, production standard, and schedule. These often simultaneous functions are usually behind-the-scenes and unnoticed when, for instance, a highly automated plant is described or a new line of Widgets is introduced. They are, nevertheless, vital to production operations.

The tools of production and inventory control people are paper, pencils, charts, and a myriad of order, equipment, raw material, and similar records. They are aware of the problems associated with the bushels of such reports flowing through their plants and are eager to apply new methods and equipment, such as electronic data processing, to their tasks. Many already have translated plant records to electronic computer system punched cards and tapes.

With this sketchy description of the production and inventory control field it is easy to see why a national organization has been formed to serve their common needs. The fact that it took until now to form it is an indication of the more recent feeling of the individuals and their companies in recognizing their place in industrial plants. The organization itself is practically an outgrowth of the production and inventory control courses and seminars sponsored by the National Institute of Management. In its 15 courses the past few years, NIM Managing Director Nyles Reinfeld estimates that 400-500 production and inventory control people have received training there. A group of these began work on the national society a year ago. The chartering of the American Production & Inventory Control Society in October is the first concrete result of their joint efforts. Presentation of technical papers on subjects related to their field and the other organizational projects will follow. Already chapters are being organized in Cleveland, Detroit, Louisville and New Bedford.

end

Cincinnati Filmatic No. 3's

Make Your Tough Centerless Grinding Jobs Look Easy and Cost Less

Thrufeed grinding 4" steel bars, or infeed grinding multiple diameter spindles up to 20" long are tough jobs for any centerless. CINCINNATI® FILMATIC No. 3's make these jobs, and thousands of in-between sizes and shapes, look easy and cost less. The No. 3's are extra powerful to give you extra productive capacity combined with Cincinnati's well-known dependability of performance. Contributing factors to these desirable elements of low production costs include:

1) **Fixed bedrock mounting of the grinding wheel spindle for fast, economical grinding**

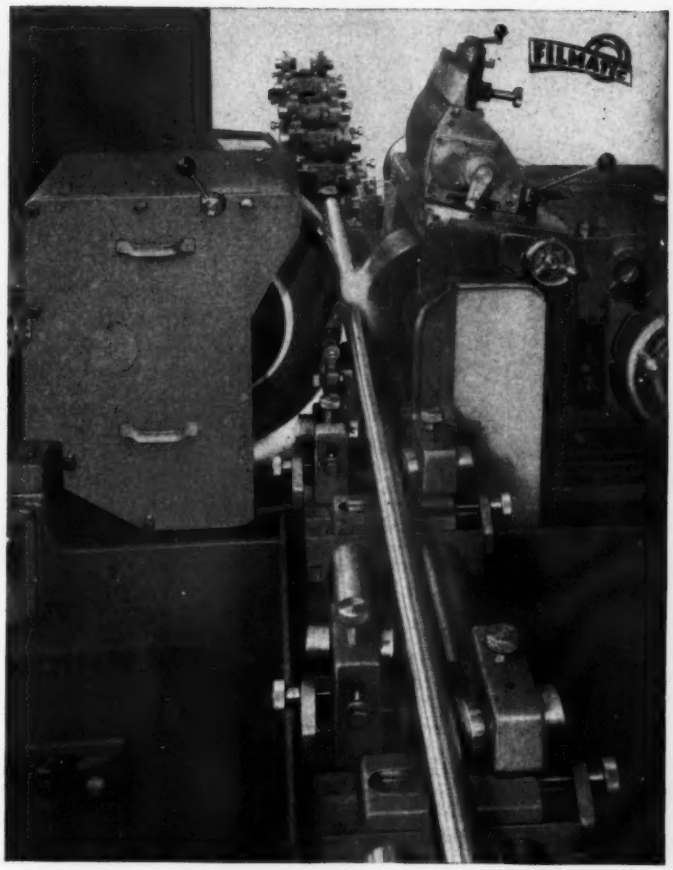
2) **FILMATIC grinding wheel spindle bearings for highest quality performance and zero maintenance. They're self-adjusting for every job**

3) **Pre-loaded, precision anti-friction regulating wheel slide, for super-precise size control**

4) **Infinitely variable regulating wheel speeds ranging from 10 to 320 rpm, for quick selection of the correct speed**

5) **Automatic grinding wheel balancing (supplied at extra cost)**

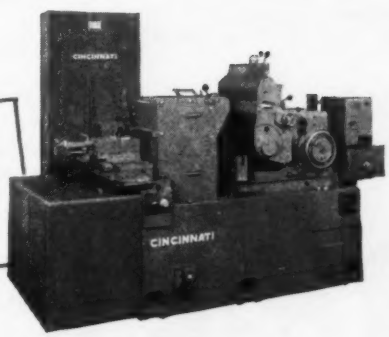
Eleven additional features and their relation to the proved dependability and productive capacity of CINCINNATI FILMATIC No. 3 Centerless Grinders are outlined in catalog No. G-664-1. Ask for a copy today. You will find brief data in Sweet's Machine Tool File.



Solid steel bars, up to 4" diameter x 18 feet long, are ground on a CINCINNATI FILMATIC No. 3 Centerless Grinding Machine equipped with Type D Long Bar Grinding Attachment.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CINCINNATI FILMATIC No. 3
Centerless Grinding Machine
Catalog No. G-664-1



CINCINNATI

CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 105

AVOID the **HIGH COST** and difficulty of fabricating long, hard & straight parts by conventional methods . . .

THOMSON

60 Case

hardened and ground

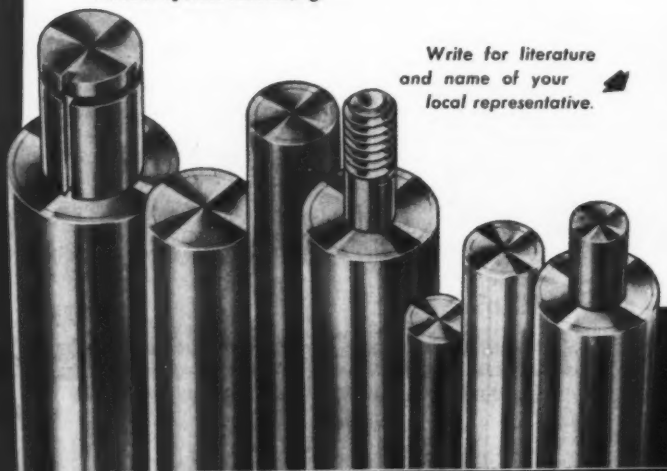
SHAFTS, ROLLS, GUIDE RODS and other long-round parts

60 Case is the result of over ten years of experimental work and production experience with hardened and ground shafts which are a requirement for BALL BUSHINGS, the Linear Ball Bearing manufactured by Thomson Industries, Inc.

The special techniques and equipment that have been developed enable high production rates and low handling costs. This permits big savings over conventional methods which are plagued with erratic warpage, straightening and resultant grinding problems. Finished *60 Case* parts frequently cost less than the scrap losses that result from conventional methods.

60 Case material has a surface hardness close to 60 on the Rockwell C scale which is essential to resist wear.

Long lengths of material ranging in diameter from ¼" to 4" are stocked to enable prompt shipment of *60 Case* parts, with or without special machining.



Write for literature and name of your local representative.

ADVANTAGES of *60 Case*

- COST REDUCTION
- HARD BEARING SURFACE
- ACCURATE DIAMETERS
- GROUND FINISH
- STRAIGHT PARTS
- DELIVERY FROM STOCK
- ADDED STRENGTH
- UNIFORM HIGH QUALITY

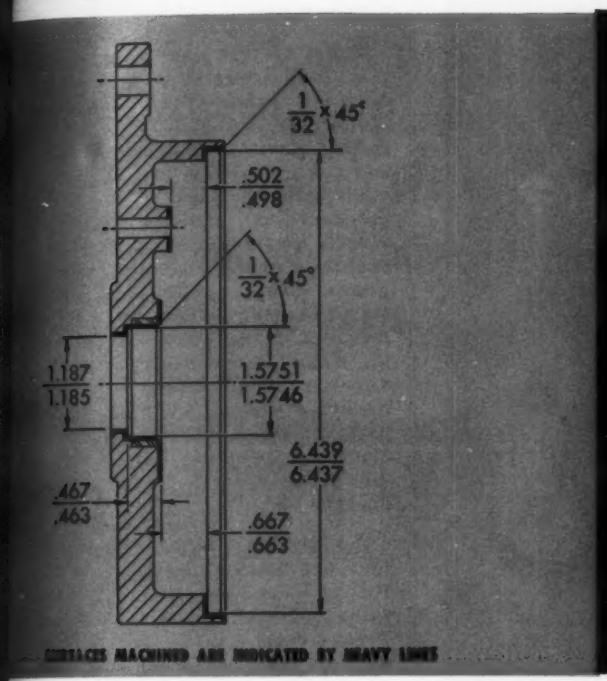
TYPICAL *60 Case* PARTS

GUIDE RODS, SHAFTING, ROLLS, TRAVERSE RAILS, PISTON RODS, ARBORS, LEADER PINS, TIE RODS, KING PINS, AXLES, CONTROL RODS, GUIDE POSTS, MANDRELS, BEARING ROLLERS, SPINDLES

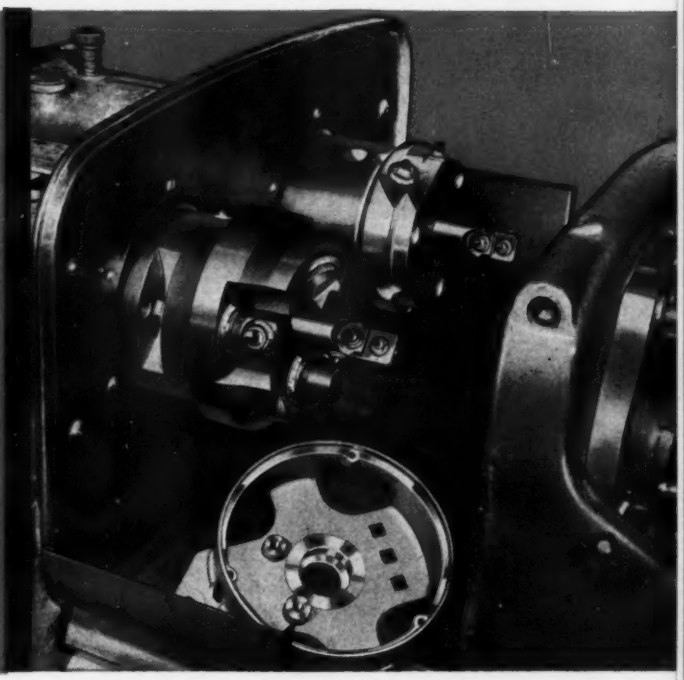
THOMSON INDUSTRIES, Inc.

Dept. C1, Manhasset, New York

9 surfaces rough and finish machined in 2 passes...



SURFACES MACHINED ARE INDICATED BY HEAVY LINES



HOW MICROBORE CLUSTER TOOLING DOES IT ON A PRECISION BORING MACHINE!

Special Microbore Cluster Tooling makes it possible for a leading electrical equipment manufacturer to obtain a continuous flow of finished parts by rough and finish machining, simultaneously, nine surfaces on a generator end bell casting in two passes.

SET-UP TIME IS FASTER, TOO—Independent, precision adjustment of each tool point permits accurate settings in a matter of seconds. Speed and accuracy of adjustment, plus compactness of Microbore units, makes cluster tooling practical to a degree formerly considered impossible.

Microbore is a versatile tool with unlimited application for all types of boring, turning and facing operations. Microbore Standard Boring Bars, Boring Bar Sets and Flash-Change tooling complete the perfect combination for accurate, quick change tooling.

•To find out how Microbore can help you, write for our new catalog No. 58.

DeVlieg Microbore System

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

2720 West Fourteen Mile Rd., Royal Oak, Michigan

a REVERSIBLE grinder?

and why not?

Both edges of the numerous splines in this pitch lock housing must be carefully deburred. The shape of the part prevents working from both ends, so an ordinary single-direction grinder just won't do. So—you simply use a Buckeye *reversible* grinder. Start the job with a grinding wheel, switch to a stainless steel wire brush, then finish up with a tampico brush—and use the same Buckeye tool all the way.

Results? These precision aircraft parts will be subjected to 2500-lb. operating pressures, and must be finished perfectly. And they are, for each part is inspected under a 25-power microscope to make certain not even the tiniest burr has been overlooked, and to see that exact tolerances haven't been disturbed. That's real finishing . . . Buckeye tools finishing!

Why AIR Tools?

Because air is everywhere, just waiting to be put to work . . . because continuous operation can't possibly harm an air tool . . . and because, if you're using Buckeye air tools, you can almost forget about tool maintenance.

Buckeye Tools

CORPORATION

5071 SPRINGBORO PIKE • DAYTON, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 108

TRADE GROUPS ELECT OFFICERS, DIRECTORS

Two leading industrial groups — the National Machine Tool Builders' Association and the Pressed Metal Institute — elected new officers and board members at their recent annual meetings.

At the NMTBA sessions at French Lick, Ind., Alfred V. Bodine, president and treasurer of the Bodine Corporation was elected president; Ralph J. Kraut, president of Giddings and Lewis Machine Tool Co., first vice president; Alan C. Mattison, president of Mattison Machine Works, second vice president; and Graham E. Marx, vice president and general manager of The G. A. Gray Co., treasurer. Walter K. Bailey, president of the Warner & Swasey Co. was re-elected secretary of the association, and Ludlow King was re-elected executive vice president. New directors are Mr. Mattison, Mr. Marx, and Julian C. Pease, executive vice president of The New Britain Machine Co.

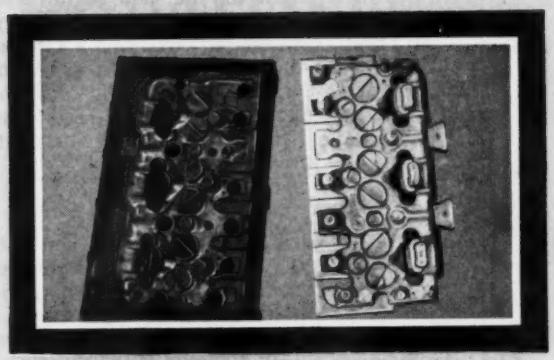
C. E. Stryker of Maysteel Products, Inc., was elected president of the PMI at its annual meeting in Bermuda. Carter Higgins, Worcester Pressed Steel Co., was named first vice president; Darwin W. Clay, Parish Pressed Steel Division of Dana Corporation, second vice president; Bryant Gemmil, The American Stamping Company, secretary-treasurer; and Mel Lorentz, HPL Manufacturing Company, assistant secretary-treasurer.

New PMI board members include Johan M. Andersen, Russell E. Anger, Seth G. Atwood, Glenn Ball, Melvin R. Blume, C. R. Boeckler, Bernard L. Brierton, George H. Drayton, Jr., N. D. Dunlap, James A. Leake, Stanley F. Paulin, F. F. Rimmler, James McC. Sessions, M. A. Sherwood, Walter S. Sutowski, P. C. Wood, and Wilson A. Wright.

As this issue goes to press, results of the National Tool & Die Manufacturers' Association election have been released. New president of the association is Phil Marsilius, vice president of The Producto Machine Co. Jack Kleinoder of Volkert Stampings, Inc., is now first vice president, and Harold B. Murdock of Arrowsmith Tool & Die Corp., second vice president. Robert C. Renner of East Dayton Tool & Die Co., has been re-elected treasurer, and James A. Perdy of the Atlantic Manufacturing Co. is new secretary.

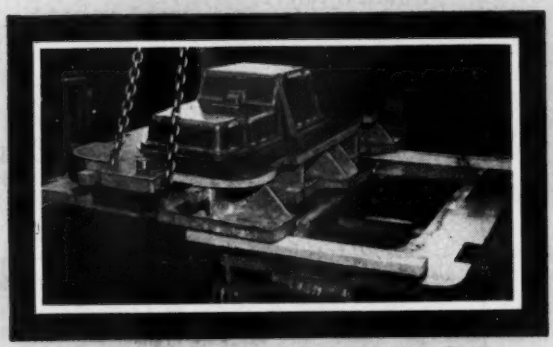
EPON® RESIN does it!

Speeds up International Harvester's Milwaukee Works' pattern modifications 65% ...cuts costs 50%!



Minimizes costs of design changes—International Harvester saved $2000 by making design modifications on an Epon resin model (right) of original drag jacket corebox (left).

Both model and mold are produced from an Epon resin-glass cloth laminate made for International Harvester's Milwaukee Works by Kish Industries, Inc., Lansing, Michigan.



Epon Resin simplifies pattern production—Epon resin faced cope and drag patterns for an IH engine can be drawn from molds with little danger of sticking.

Here's how:

AT INTERNATIONAL HARVESTER CO., world-famous manufacturers of farm equipment, Epon resins have created a money-saving revolution in foundry pattern modification.

For example: to enlarge the cross section of a frame casting for an IH crawler tractor, a pattern change would normally require 3 weeks and cost $700. *But by applying Epon resin . . . costs dropped to $300 . . . and the pattern was back in production in 1 week!*

In another situation, the use of Epon resin to make a plastic core model of a new drag jacket corebox from the old one saved IH over $2000.

In many fields of industry, the Epon resins are making such savings possible because they have ideal properties for tooling applications:

- Exceptional dimensional stability . . . high impact strength . . . excellent resistance to abrasion . . . minimum residual stress in cured parts.
- Ease and speed of preparation.
- Low shrinkage in filled formulations, assuring perfect master reproductions; minimum warping and stresses.
- Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

Can Epon resin tools and dies make comparable improvements and savings in *your* operations? Find out now by writing your tooling resin formulator.

SHELL CHEMICAL CORPORATION

CHEMICAL SALES DIVISION, 380 Madison Avenue, New York 17, New York

Atlanta • Boston • Chicago • Cleveland • Detroit • Houston • Los Angeles • Newark • New York • San Francisco • St. Louis
IN CANADA: Chemical Division, Shell Oil Company of Canada, Limited • Montreal • Toronto • Vancouver

SHELL

CIRCLE INFORM-A-GRAM KEY NO. 109

MANUFACTURING MEMOS

Reorganization . . .

• U. S. Industries, Inc. has reorganized and consolidated manufacturing and marketing functions in three of its major divisions. The company has integrated the operations of these divisions along product group lines. Clearing Machine Corp. becomes the central producer of heavy-duty machine tools, and Axelson Mfg. Co. is the central oil production equipment facility.

New Office . . .

• New adviser to director of the Metalworking Equipment Division of the Business and Defense Services Administration, U. S. Department of Commerce is Arvid O. Lundell, president of Colonial Broach and Machine Co. Niels A. Olsen, a career official, is acting director of the division, succeeding Wallace E. Carroll.

Award Given . . .

• The National Safety Council received the Presteel Award of 1957 from the Pressed Metal Institute.

Anniversary . . .

• Associated Spring Corporation's Wallace Barnes Company Division celebrated the 100th anniversary of its founding.

Enters Automation . . .

• The Parker-Kalon Division of General American Transportation Corp. is entering the automation equipment field. It has acquired the exclusive American manufacturing and sales rights to patented Pneuma-Serve fastener feeding equipment.

Good Management . . .

• Toro Manufacturing Corporation, maker of power mowers, has been cited for "excellence . . . of management" in a special audit report by the American Institute of Management.

Two Receive Award . . .

• Robert M. Riblet and Charles M. Kitson, both of the Automotive Division, Timken Roller Bearing Co., have been selected to receive the L. Ray Buckendale Award awarded by the Society of Automotive Engineers, Inc.

Prize Winners . . .

• Three manufacturing firms and a university were winners in the Industrial Management Society's Methods Improvement Competition held in conjunction with the 21st annual Industrial Engineering and Management Clinic. Hersey Mfg. Corp. and Texas Instruments, Inc., won first prizes; Allis-Chalmers Mfg. Co. won top award for methods improvement in the office; and Bradley University won first place in the student division.

Robertshaw-Fulton Controls Co., a manufacturer of automatic control devices, has changed the name of its Fielden Instrument Division to the Instrument Division. It has expanded its activities into the fields of vibration monitoring and laboratory instrumentation.

◆

Purchase of the Krouse Testing Machine Co., of Columbus, O. by The Budd Co. has been made known. This acquisition along with the recent establishment of the Tatnall Measuring Systems Co., now provides Budd with a complete line of testing equipment.

◆

The Nutt-Shel Co. has been acquired by Standard Pressed Steel Co. The Nutt-Shel line of fixed and floating anchor nuts, dome nuts, gang channel, and bolt retainers complements the line of standard hexagon locknuts made by Standard Pressed Steel.

◆

A merger of The Midland Steel Products Co. and J. O. Ross Engineering Corp. has been announced.

◆

Detroit Bevel Gear Co., a subsidiary of Gear Grinding Machine Co., has been sold to Napco Industries of Minneapolis.

◆

A new short-run stamping plant in North Hollywood, Calif. has been opened by Federal Tool and Mfg. Co. to provide faster service for West Coast industries.

◆

The Parker Appliance Co. purchased Hannifin Corp. and has changed the name to Parker-Hannifin Corp. The two companies make complementary products in the field of fluid power.

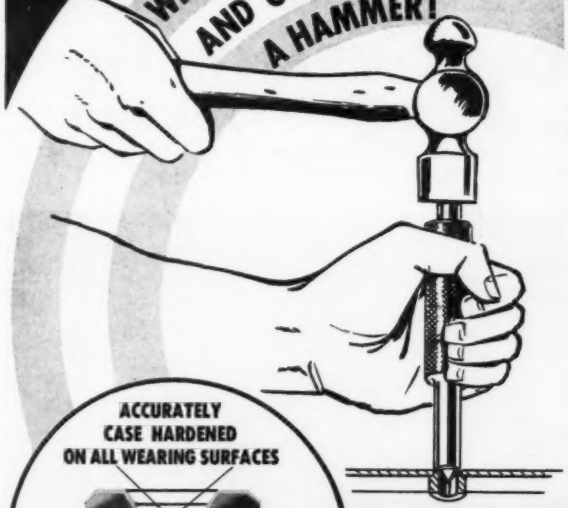
◆

Herman P. Good, division manager of Textile Machine Works, was honored by the Gray Iron Founders' Society by receiving the Association's highest award, the Gold Medal. He was honored for outstanding service to the Association and the industry.

◆

A. Milne & Co., Inc., distributor of solid and tubular tool steels, has moved its New York sales office and warehouse to new, expanded facilities in Kenilworth, N. J.

REVOLUTIONARY!
CUT TOOLING COSTS WITH
NEW!
FLAR-A-LOCK®
TEMPLATE
DRILL BUSHINGS
AND WORK LOCATORS
FOR 1/16" OR 1/8" SHEET STEEL OR ALUMINUM
SECURELY INSTALLED WITH ONLY A FLARING TOOL AND ONE IMPACT OF A HAMMER!



ACCURATELY CASE HARDENED ON ALL WEARING SURFACES
MALLEABLE SHANK FLARED FOR POSITIVE LOCK

NO SKILL REQUIRED
QUICK • ACCURATE
NO RIVETS
NO PRESSES

ALSO AVAILABLE FOR PLASTIC TOOLING AND ¼" MASONITE BOARD

Write Today For Catalog #102A

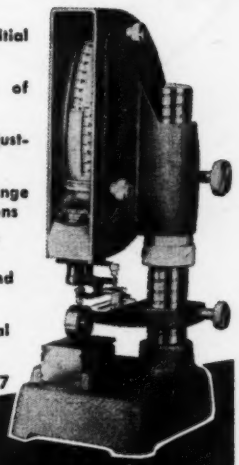
TECHNO-PRODUCTS CORP.
143 Netherwood Drive, Springfield, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1111

Leitz TOLERATOR
THE TRU-VISION
COMPARATOR GAGE
Capacity 6" Diameter

- Positive action through low-ratio initial amplification of 4:1
- Additional optical amplification of 250:1 = total of 1000x
- Rapid quantity gaging between adjustable colored tolerance masks
- Selective inspection from long range illuminated scale with 100 divisions
- Direct effortless reading in .00005"
- Variety of interchangeable anvils and contact tips
- Instrument also available for internal gaging

Request 8-page catalog 82-177



OPTO-METRIC TOOLS, INC.
137 TP VARICK STREET, NEW YORK 13, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1112

ACCURACY
.0002 T.I.R.
.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943
MOTOR DRIVEN
WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

CIRCLE INFORM-A-GRAM KEY NO. 1113

The formed metal stamping illustrated above is produced complete on the U. S. No. 33 Multi-Slide Machine shown below.

ON FORMED STAMPINGS REDUCE COSTS WITH U. S. MULTI-SLIDES®

If you produce formed metal stampings, the U. S. Multi-Slide may be the answer to your cost reduction problems. The part illustrated is just one of the many different types of stampings that can be produced complete on the U. S. Multi-Slide — without secondary handlings . . . and every such operation that can be eliminated increases your profit potential.

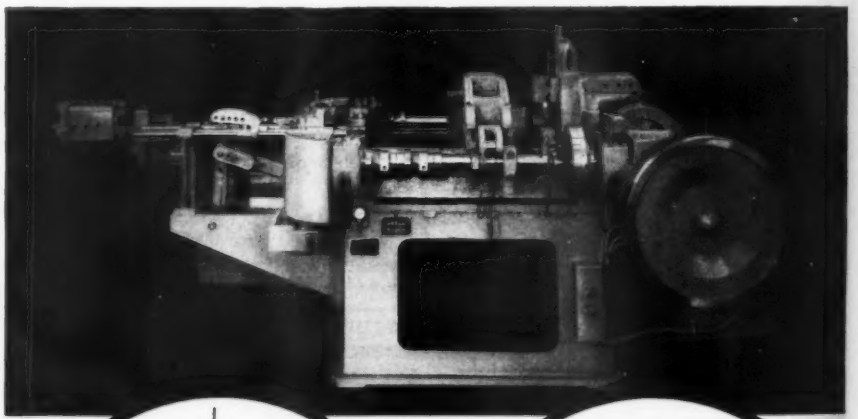
The combination of ram action, four-slide forming, vertical stripper and various auxiliary units allows for the designing of tools to produce intricate parts complete — without secondary operations. Since these movements are an integral part of the machine equipment, it is not necessary to incorporate complicated movements into the dies themselves, thereby giving the added advantage of reduced tool maintenance cost.

Investigate! Ask for a copy of Bulletin 15-P, or send us part drawings or samples for our recommendations.

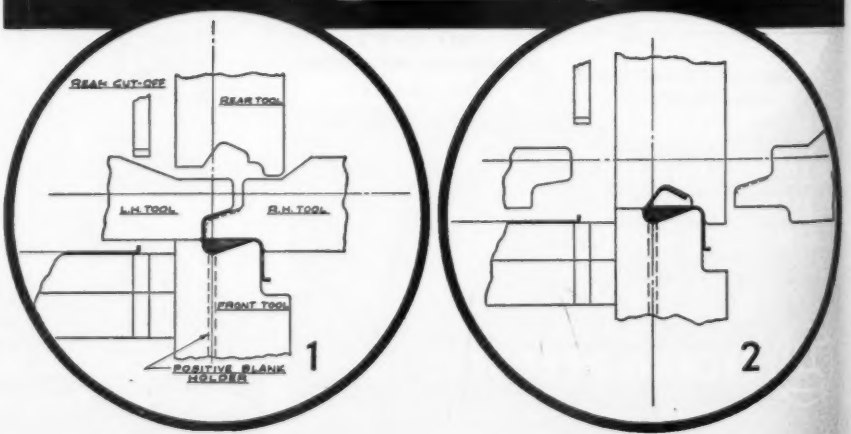
U. S. TOOL COMPANY, Inc.

AMPERE (East Orange) **NEW JERSEY**

Builders of U. S. Multi-Slides — U. S. Multi-Millers — U. S. Automatic Press Room Equipment — U. S. Die Sets and Accessories



Right: The No. 33 U. S. Multi-Slide with capacity for material up to 2½" wide, with feed length adjustable up to 12½".



Right: Operations in the forming position. 1 — Front, right-hand and left-hand tools entered to preform part around post. 2 — Right-hand and left-hand tools retracted; front and rear tools entered to complete the form.

CIRCLE INFORM-A-GRAM KEY NO. 112

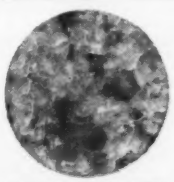
DoALL ACQUIRES WORLD'S FINEST SOURCE OF BLACK GRANITE-*DIORITE* FOR SURFACE PLATES

NO SOFT SPOTS

WON'T SCRATCH

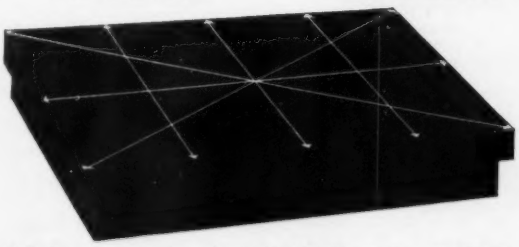
BLACK GRANITE

So dense and smooth a scriber can't find soft spots nor will it scratch sensitive acetate. DoALL Black Granite-Diorite is the superior material in all ways. You can see its denser grain structure, compared with pink and gray.

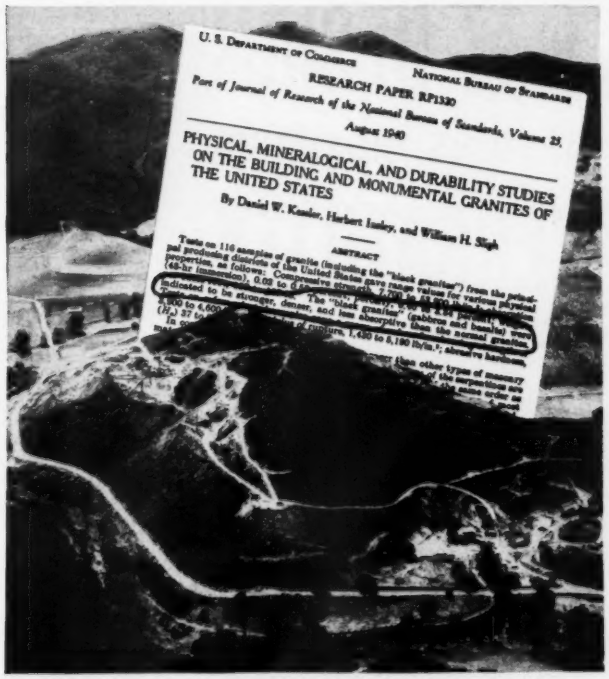


PINK GRANITE

GRAY GRANITE



A better accuracy standard. DoALL Black Granite-Diorite surface plates are specified from an *over-all mean plane*, not per square foot area.


U. S. Department of Commerce
National Bureau of Standards
RESEARCH PAPER RP1320
Part of Journal of Research of the National Bureau of Standards, Volume 25, August 1940
PHYSICAL, MINERALOGICAL, AND DURABILITY STUDIES ON THE BUILDING AND MONUMENTAL GRANITES OF THE UNITED STATES
By Daniel W. Kessler, Herbert Insley, and William H. Sligh
ABSTRACT

Home of DoALL Black Granite-Diorite is this Quarry No. 115 near Escondido, California, which the National Bureau of Standards lists in its research paper R.P. 1320 and Fed. Spec. 666-P-463 as the source of finest Black Granite-Diorite.

SEE THE DIFFERENCE IN YOUR OWN SHOP

While granites in general are usually selected as surface plate material over cast iron, much confusion exists as to *which* granite *is the best.*

Different types of granite have varying degrees of soft spots or lack toughness and resistance to wear. Others do not have the density necessary for greatest strength and least porosity, and some types cannot be properly lapped to a fine finish. All of these factors lessen the degree of accuracy obtainable. In its search for better granites, the National Bureau of Standards Research Paper RP-1320 states: "The Black Granites (gabbros and basalts) were indicated to be stronger, denser and less absorptive than the normal granites."

By obtaining the best in granites, DoALL can impart its years of gaging experience to the manufacture of the finest in surface plates.

Take advantage of our *Free Trial* offer to find out why DoALL Black Granite-Diorite is preferred over all other surface plate material.

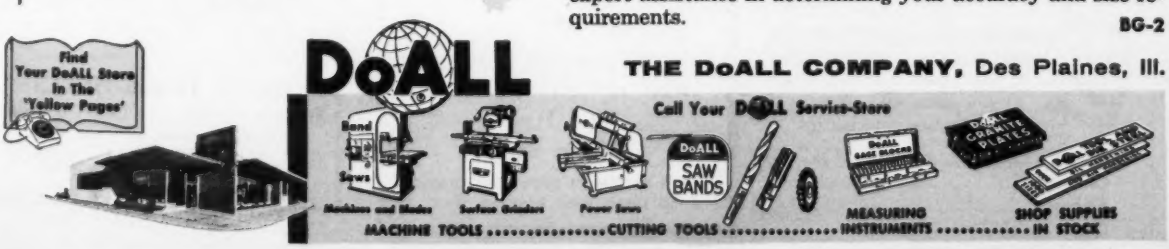
Call your DoALL Gage Specialist now; he will give you expert assistance in determining your accuracy and size requirements.

BG-2

10-DAY FREE TRIAL OFFER!

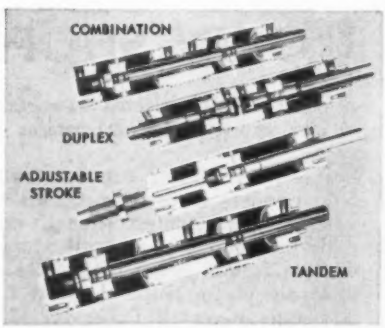
Prove for yourself in your own plant the superiority of Black Granite surface plates. We will deliver your choice from these four sizes: 8" x 12", 12" x 18", 18" x 24" and 24" x 36".

THE DoALL COMPANY, Des Plaines, Ill.



O-M DESIGN assures maximum VERSATILITY

The O-M Internal key-type cylinders are not only the most compact, streamlined and efficient cylinders on the market today; but they also easily lend themselves to modification. Using a majority of standard parts and one or two semi-standard parts, you get the advantages of "special" cylinders designed to do your job better at a very nominal extra over standard cylinder prices. Here are only a few of the combinations available.



Consult your O-M Representative or the factory for specific recommendations for your application. Use coupon for name of representative nearest you and copies of O-M standard cylinder catalogs.

SEND IN COUPON TODAY

ORTMAN-MILLER MACHINE CO

21 143rd Street, Hammond, Indiana

☐ Have representative call

☐ Send Bulletins 101A and 105

Name_____ Position_____

Company_____

Address_____

City_____ Zone_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 1141

Smoother Production! Higher Output! Lower Costs!

RICE-MILWAUKEE

DIE FILERS . . . for straight-line sharp corner filing, sawing and lapping.

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

PROFILE GRINDERS

. . . for high speed Precision Grinding of Curved and Irregular Contours.

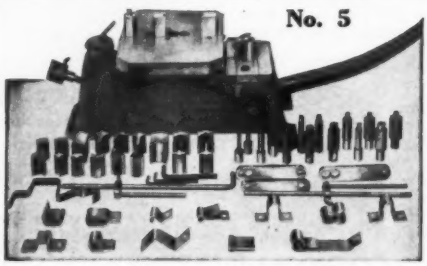
Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

Write for Illustrated Bulletins and Prices

RICE PUMP & MACHINE COMPANY

228 PARK AVENUE BELGIUM WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 1142



WRITE FOR DESCRIPTIVE CIRCULAR

J. A. RICHARDS COMPANY

Multiform

BENDER-CUTTER

CUTS, BENDS, PUNCHES

Available in hand, air or hydraulic models. The MULTIFORM is shipped complete with full assortment of dies and mandrels to form and cut round or flat stock up to ⅛" x 1½" as illustrated. Punching dies available. Other models up to ½" x 8" hydraulic operated. Ideal for steel rule die forming.

ALSO AIR OPERATED MODELS

KALAMAZOO, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 1143

ULTRA-CHEX GAGE BLOCKS *for Every Need!*

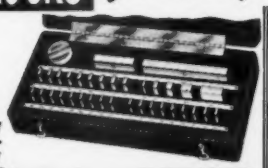
Supplied in one Superior Accuracy

5 MILLIONTHS ± ACCURACY

34 BLOCK SET (shown) WITHOUT OPTICAL PARALLEL ..$125.00

82 BLOCK SET.....$260.00 IN CASE

These sets will supply the needs of any discriminating shop that must work to gage-block precision. IMMEDIATE DELIVERY



WRITE FOR ILLUSTRATED FOLDER

9 Block Set For Individual Mechanic $24.75

OPTICAL PARALLELS $6.00 Extra

GEO. SCHERR CO., INC. 200-T LAFAYETTE STREET • NEW YORK 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1144

JIG BORING

and

Large Precision Machining

Done to your specifications

We Have

22 Jig Borers

KIDDE PRECISION TOOL CORPORATION

10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1145

DRILL THESE HOLES

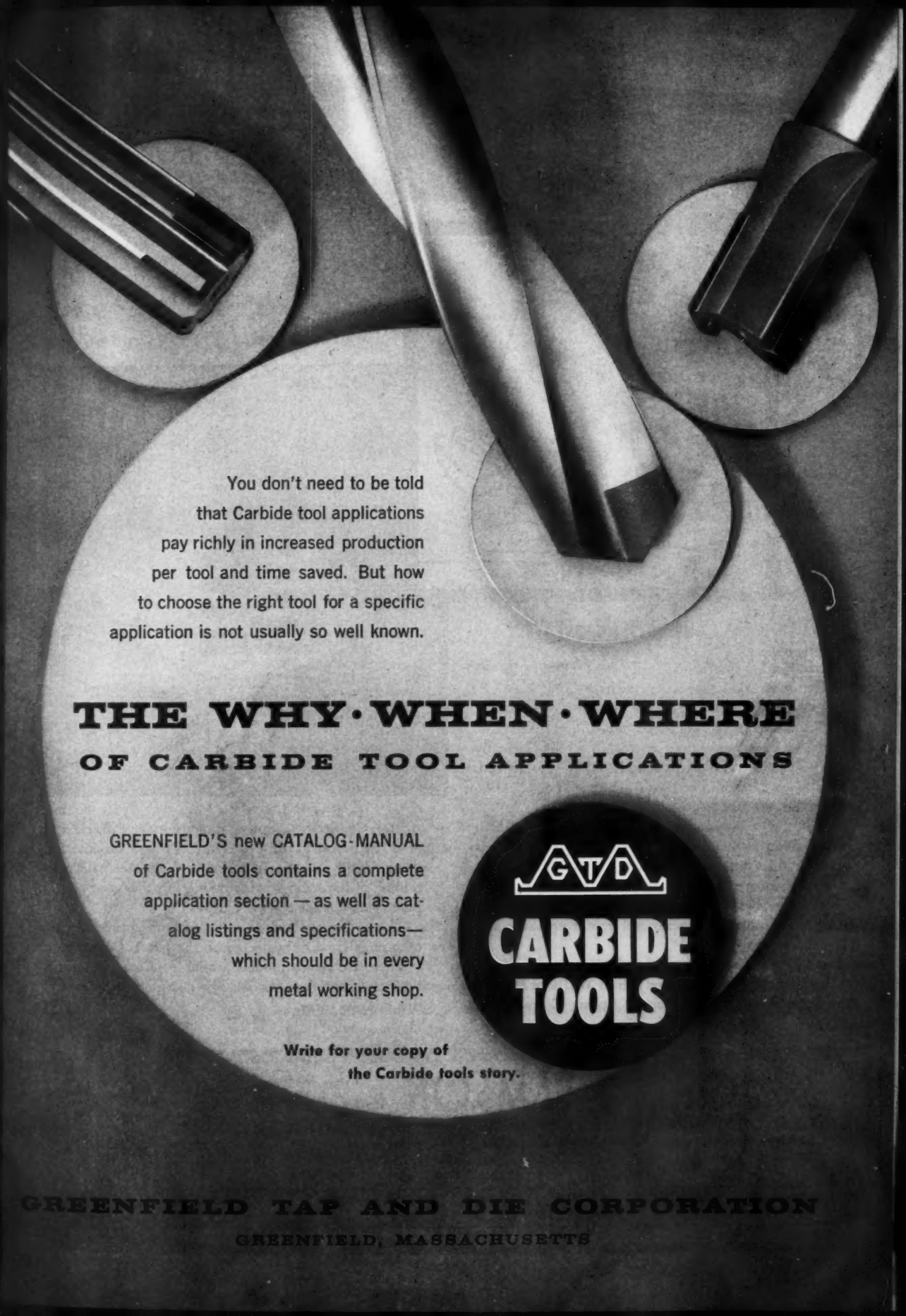
BY A QUICK, EASY, INEXPENSIVE METHOD

Your business letterhead will bring literature.

WATTS BROS. TOOL WORKS

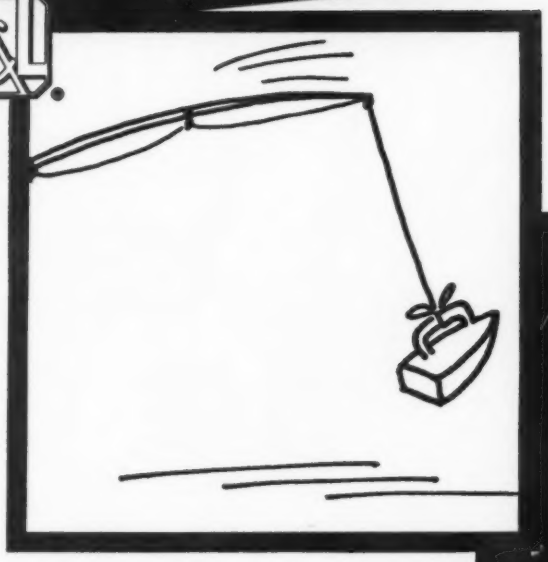
Wilmerding, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1146


You don't need to be told
that Carbide tool applications
pay richly in increased production
per tool and time saved. But how
to choose the right tool for a specific
application is not usually so well known.
THE WHY·WHEN·WHERE
OF CARBIDE TOOL APPLICATIONS
GREENFIELD'S new CATALOG-MANUAL
of Carbide tools contains a complete
application section — as well as cat-
alog listings and specifications—
which should be in every
metal working shop.
GTD
CARBIDE
TOOLS
Write for your copy of
the Carbide tools story.
GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

DROODLES

by ROGER PRICE



"CAST IRON"

This ice-fishing tackle, invented by me, shows how far the mind of man can soar if it's able to. For the technical-minded: I use a Lazy Daisy 2B flat iron, with 400-lb. test clothesline and a 7-foot section of old vaulting pole. When I let fly with plenty of wrist whip, a hole magically appears in the ice, and the fish lurking below get brained. That's when I move in fast with my net. What could be simpler and more ingenious?

About the only thing I can think of is the J & L Optical Comparator. It's very simple to operate and ingeniouser than practically anything. This marvelous instrument measures and inspects all sorts of parts and objects, laterally, vertically and angularly—it also inspects by reflection, by tracing and from overhead—and it's accurate, too (to .0001").

Don't take my word for it; here's an example of the Optical Comparator on the job at Wallace Barnes Company Division of Associated Spring Corporation, Bristol, Connecticut. Spring dimensions are checked to .010" by means of the J & L Model PC-14 Comparator, using a grid chart at 10 magnifications. Accurate positioning of the springs is maintained by means of a focal plane glass on the staging fixture.

The special tools used in manufacturing various types of springs are also inspected on the J & L Comparator.

There are eleven models available—from a 7" Bench type to a 30" floor model. For complete details, send this coupon *today*.

"The originator of machine tool standards in optical inspection"

JONES & LAMSON

Floor Model PC-14

JONES & LAMSON MACHINE COMPANY, Dept. 710, 519 Clinton Street, Springfield, Vt., U. S. A.

Please send me Comparator Catalog 402-C, which describes the complete line of J & L Optical Comparators.

name _____ title _____ street _____

company _____ city _____ zone _____ state _____

384

"We grind no axe . . . **and really have no need to.**" After all, Bliss makes so many types and sizes of metalworking presses—actually many more than any other builder—that we favor only the one right press for your job. It may be a big one, a little one, a mechanical, a hydraulic, a standard or a special. But you can be sure it will be the *right* one.

If you have a pressed metal problem, isn't it logical to talk to a source that's certain to give you an impartial answer? To talk to Bliss?

BLISS
SINCE 1857

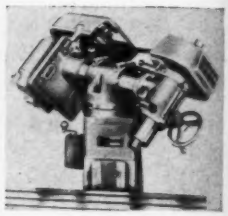
E. W. BLISS COMPANY · Canton, Ohio

100 years of making metal work for mankind

PRESSES • ROLLING MILLS • MILL ROLLS • DIE SETS • CAN MACHINERY • ORDNANCE

CIRCLE INFORM-A-GRAM KEY NO. 117

The high precision spindle and drive have 7 ball bearings . . . hardened spindle. Ground and hard chrome plated quill has full length bearing in head.



The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to machine at all angles with one set-up.

HERE'S PROOF OF PERFORMANCE . . .

"The Clausing Vertical Miller is the best machine for the money on the market today! It is most versatile . . . and extremely accurate". — F. L. BALLENTINE, EMPIRE TOOL ENGINEERING COMPANY, INC.

VERIFIED ACCURACY — Before it leaves the factory each CLAUSING Mill must pass rigid tolerance tests such as:

1. Top of table perpendicular to column ways within .0005" in 6" travel.
2. T-slots square with cross slide dovetails within .0005".
3. Table, parallel to turret within .001".
4. Spindle square with table, front to rear, within .001" T.I.R. in 5" circle.
5. Spindle taper (internal) run out within .0002" at spindle nose.
6. Table T-slots parallel to table dovetail ways within .0005" in 8" longitudinal travel.

This report is typical of the experience of users everywhere. The CLAUSING VERTICAL MILLER is a precision machine tool designed for operations where "extremely accurate" machining is required. And, it is an outstanding producer, "most versatile, easiest to set up, get around and operate of *any* miller at or near its low price." Only $850 f.o.b. factory.

MILLS, DRILLS, BORES, REAMS, SHAPES AT ALL ANGLES . . . WITH ONE WORK SET-UP!

Write FOR FREE LITERATURE

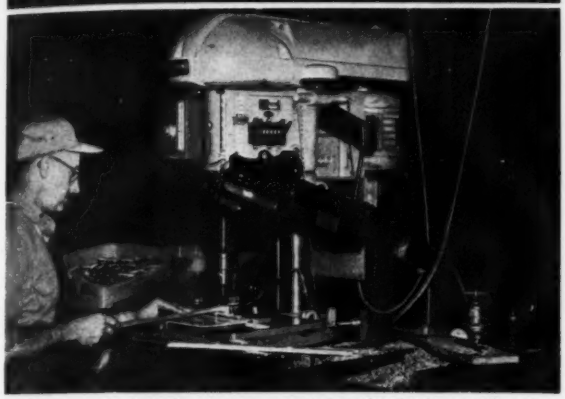
Atlas CLAUSING PRECISION MACHINE TOOLS — A DIVISION OF ATLAS PRESS COMPANY

CLAUSING DIVISION • ATLAS PRESS COMPANY

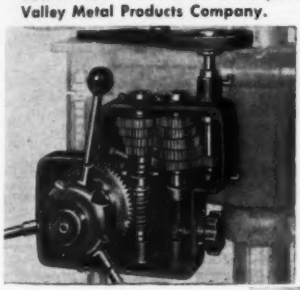
12-115 N. PITCHER ST., KALAMAZOO, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 118

It takes a HEAVYWEIGHT to do Heavy-Duty Drilling

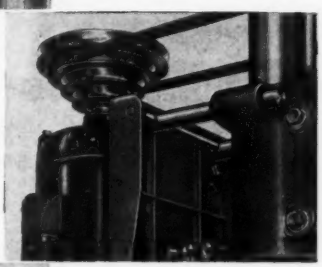


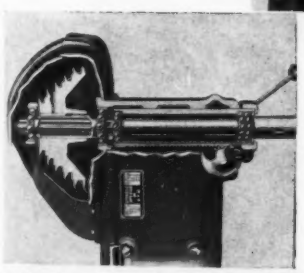
"Because of their heavier construction, CLAUSING 18" drill presses are the best producers in our plant. They increased production 22% over other drills previously used on same job!" — Valley Metal Products Company.



"CLAUSING drills have the best power feed in the industry". Gear drive, heavy-duty! No belts to dissipate power.

CAST IRON pulleys, 5-step, ⅝" B-section belt. Drive is positive — greater production — less down time, lower maintenance costs!





$6\frac{3}{64}$" tough, precision ground steel spindle! 6½" spindle travel! 5 ball bearings in head for lasting accuracy, service.

Yes, CLAUSING DRILLS have what it takes for BIG jobs!

Described here are only a few of their outstanding features that will pay out quickly in your plant. We'll gladly send you all the "weigh-in" facts on these heavyweights! Write for illustrated literature today.

15" ATLAS-CLAUSING DRILL PRESSES ALSO AVAILABLE

CLAUSING DIVISION ATLAS PRESS COMPANY
12-115 N. Pitcher St.
Kalamazoo, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 119

BOOK REVIEWS

SELECTION OF MANAGEMENT PERSONNEL. Published by the American Management Association, Inc., 1515 Broadway, New York 36, N. Y., 1957. 892 pages plus index; two volumes, boxed; $15. (AMA members: $10).

The widening search for management talent requires a thorough reevaluation of existing selection methods. Approaches to management selection based on dated information and erroneous assumptions must be replaced by new techniques which reflect modern management's changing attitudes. Based on this premise, these books report fully and authoritatively on new selection techniques. Using a general approach applicable to technical, sales, accounting, and other specialized personnel, they examine the entire selection process. For example, the essential nature of the manager's job is defined, the qualities necessary for success in business and industry are identified, and the processes for choosing and evaluating managers are described.

In addition, more than 40 leading management experts discuss such practical aspects of executive and supervisory selection as defining the job and its requirements, assuring an adequate number of candidates, and making the most of available tools and techniques. Specific testing, interviewing, and merit-rating methods are explained thoroughly. As a special feature, the volumes contain 19 case studies of actual company practices in management selection.

CREEP AND RECOVERY, by 22 authorities. Published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, 1957. 372 pages, 258 illustrations, $6.

Creep is defined as a change in dimension under constant stress, and recovery as the restoration of prior conditions. These factors are important to consider when tolerances are close and clearances precise.

This book is a collection of the papers presented at the past seminar on Creep and Recovery, held in conjunction with last year's National Metal Congress. Beginning with data on six various and interesting aspects of recovery — thermodynamics, defects, and the recovery of various physical and mechanical properties — and concluding with information on creep of crystalline metals and nonmetals, the book offers the most recent experiments and thoughts on the subjects. In all, 14 papers are presented in it.

DIRECTORY OF STEEL FOUNDRIES IN THE UNITED STATES, CANADA, AND MEXICO. Compiled and published by Steel Founders' Society of America, 606 Terminal Tower, Cleveland 13, Ohio, 1957. 280 pages, $15.

Personnel, capacity, equipment, processes employed, use of product, number of employees, and geographical locations of the Steel Founders' Society's members are listed in this new directory. Much of the basic information is coded for quicker reference.

HOT PLASTIC HOLDING PROBLEM SOLVED . . .

WITH KNU-VISE CLAMPS

KNU-VISE CLAMP H-600

It's a plastic dome skylight . . . produced by "blowing" heat softened plastic sheets under 30 lbs. of air pressure. To hold the hot plastic during the "blowing" process clamping had to be safe, positive, dependable. To handle the various sizes and shapes of skylights produced clamping had to be versatile. And to speed production, clamping had to be fast to grip, quick to release. Knu-Vise clamps provided the answer to all these requirements . . . can answer your holding problems, too. For complete information or engineering assistance write Lapeer today.

Manufacturers of over 150 models of manually and air-operated clamps and pliers

KNU-VISE PRODUCTS — LAPEER MANUFACTURING CO.

3064 DAVISON ROAD
LAPEER, MICHIGAN

WESTERN DIV.: ART LEWIS PRODUCTION EQUIP. CO.
419 Magnolia Street, Glendale, California
CANADIAN DIV.: HIGGINSON EQUIP. SALES LTD.
1131 Pettit Road, Burlington, Ontario

CIRCLE INFORM-A-GRAM KEY NO. 1201

new SCHERR
TOOLMAKERS MICROSCOPE

WITH INTERCHANGEABLE DIAL TEMPLETS AND OCULARS

Reading Angles in Minutes

Thread Templets for U. S. National Thread Profiles-6-80 Pitch. Radii Templets, etc.

LARGE MICROMETER DRUMS READ DIRECTLY IN .0001"

Measuring Range 2" x 1-1/2" and other sizes

A moderately priced PRECISION MEASURING TOOL for Toolroom and Inspection

WRITE FOR CATALOG—Code YGIIQ

GEORGE SCHERR CO., Inc.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-T LAFAYETTE STREET • NEW YORK 12, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1202

Can your tapper pass this Performance Test?

(CHECK IF "YES" ONLY)

- ☐ Maintains production for long periods
- ☐ Less operator fatigue
- ☐ Fewer Broken taps
- ☐ Less "down time" interruption
- ☐ Fewer spoiled pieces
- ☐ Maintains accuracy at high speeds

If You Cannot Answer Yes to Each of the Above . . . Your Tapper is Not Operating Efficiently

There is a difference in tapping heads and in Procunier you'll find that unmistakable difference. If your tapper is not producing up to par—regardless of your demands and schedules—it will pay you to check into the possibility of using Procunier. They have been consistently producing "profitably" under "back breaking" production schedules everywhere!

Procunier superiority can be attributed to many unique construction features: practical double cone cork faced friction clutch, wobble free spindle, quick start, stop and reverse mechanism, finger tip control, exclusive tap holder, plus others. Get the full story today.

Write for Free Brochure giving the full Procunier Story. It's yours for the asking.

PROCUNIER SAFETY CHUCK CO.
12-14 So. Clinton St., Dept. 12, Chicago 6, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1203

Rods Balls Screws Candles Nuts Discs Toy Parts Pins
FEEDING
Washers Die Cast Parts Bushings
Molded Parts
ORIENTING
Buttons Tablets Capsules
Lock Washers Plastic Parts Dowels
Electrical Parts Pills Nails Rolls Rivets
COUNTING
Ferrules Set Screws Pegs
Studs Tokens Coated Gums
WITH Hoppermatic
Bouillon Cubes Die Cut Parts
Bolts Screw Machine Parts
Sintered Parts Rubber Plugs

TO 200,000 PARTS PER HOUR

NOW AVAILABLE FOR THE FIRST TIME is a completely standardized, versatile, high speed hopper, quickly adjustable for size, shape and count.

ONLY 5 MINUTES CHANGE-OVER TIME
WRITE FOR DETAILS

U.S. ENGINEERING COMPANY
40-21 22nd St., Long Island City 1, N. Y. Phone: STillwell 6-7848

CIRCLE INFORM-A-GRAM KEY NO. 1204

Simple...Positive...Faster...Accurate Indexing with TRIG-R-DEX

Trig-R-Dex is a completely new concept in manual indexing that simplifies and speeds straight or spiral operations.

To index—simply grasp the Trig-R-Dex handle, push down on the trigger button and move the handle until index pin engages the next hole, pull handle to stop position and you have indexed one increment. During work processing operations, the Trig-R-Dex handle always remains stationary. But, the index plate is keyed to the driver holding the work center . . . this assures the index plate, center and workpiece turn as a unit.

By selecting proper index plate, both right- and left-hand operations having from one to ten spaces can be accurately indexed. Changing from one index plate to another is extremely easy and takes but a couple minutes.

Because Trig-R-Dex is simple in design, of rugged construction, easy to operate and precision made, it will give years of accurate, trouble-free service while reducing costs and boosting your production.

U.S. PATENT NO. 2,711,324

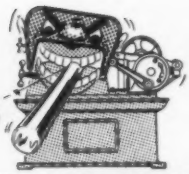
For further information, write to:

DETROIT REAMER & TOOL COMPANY

780 W. MAPLE ROAD • P.O. BOX 174 • BIRMINGHAM, MICH.

CIRCLE INFORM-A-GRAM KEY NO. 121

New Bite for POWER HACK SAWS with



GUILLOTINE DuWeld PRO-SET
finishing teeth have heavier set
PRO-SET: progressively wider set teeth
entering teeth have lighter set

GUILLOTINE DuWELD® PRO-SET TRADE MARK
POWER BLADES

● Guillotine DuWeld Pro-Set Power Blades feature a completely new concept in sawing.

Teeth and gullet capacities are identical in size but the amount of set increases in infinite degrees from starting to finishing ends of the blade. Impact at start of stroke is reduced 50%.

Metal is gradually and smoothly displaced instead of being "hogged" out. Chip load per tooth is greatly reduced.

Progressive cutting action is constant regardless of size of work piece. Every tooth is a working tooth resulting in 33⅓% more cutting action.

The chips are the proof. The tightly curled chips, generated by DuWeld Pro-Set Blades, are extremely elongated triangles when examined under glass, showing the progressive tooth loading action.

SEND FOR FREE BLADE TENSIONING CHART
Describes the new simplified *Counted Turn* Method. Eliminates gimmicks and gadgets.

POWER BLADE DIVISION
THE E. H. WACHS CO.
1525 North Dayton St., Chicago 22, Illinois
Phone Michigan 2-4650

CIRCLE INFORM-A-GRAM KEY NO. 1221

Remote control or movement duplication your problem? find out why...

Sperry

Hydraulic REMOTE CONTROLS *are your best answer*

TP 12

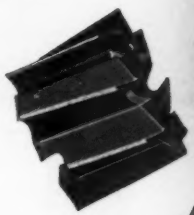
SPERRY PRODUCTS, INC.
1103 Shelter Rock Road
Danbury, Connecticut

☐ Send complete hydraulic control information
☐ Have technical representative call

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

CIRCLE INFORM-A-GRAM KEY NO. 1222

Systematic "NTS" salvage is the best way to cut cutting tool costs



Stop before you discard a worn or damaged cutter. It may be worth many times its scrap value!

Since 1912 we have been restoring all kinds of cutting tools to new usefulness to help shops control their cutter costs.

Can we assist you in studying your operations and tool usage to determine if a salvage program will save money in your plant? There is no obligation.

Write for this catalog and the salvage story.

NATIONAL NTS TOOL SALVAGE

NATIONAL TOOL SALVAGE CO.
6511 EPWORTH BOULEVARD DETROIT 10 MICHIGAN

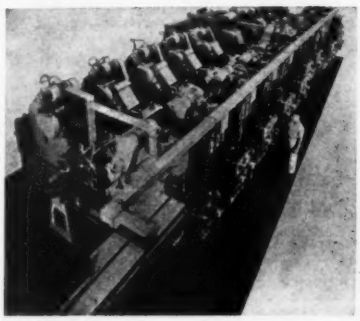
CIRCLE INFORM-A-GRAM KEY NO. 1223

V-8 Engine Blocks Machined on 10-Unit Transfer Machine

A 10-unit transfer machine has been built for multiple machining operations on automotive V-8 engine blocks.

As each engine block passes through the various stations of this machine built by the Moline Tool Company, the eight cylinders are rough bored, semi-finish bored and counterbored, and both ends of each cylinder are chamfered. Valve clearances are also machined.

An idle station between each two working stations permits the workpiece to lose some of the heat generated by the machining operations. The idle stations also provide adequate space for any necessary maintenance work or tool checking.



Every V-type machine unit has two hydraulic feed pumps, each on a floor-mounted reservoir. Automatic lubrication of slides, ways, spindles, and gears is provided, with electrical interlocking to detect a lack of oil.

An electric control panel is provided for each machine unit in the control enclosures. Each of the 10 machine units has its own pushbutton station for individual emergency operation, and each unit also has individual electric control for each slide so that tools can be moved to or from the work for making adjustments.

All functions are tied together electrically so that the entire unit can operate as an integrated machine. Control is centralized in one pushbutton station mounted on a movable arm which can be swung to either side of the feeder station at the beginning of the transfer line.

BUY U. S. SAVINGS BONDS

Brand Names *plus* Precision Manufacture make

SHUSTER

Wire Straightening and Cutting Machines

your BEST BUY!

Only the finest components are used in the precision manufacture of Shuster Machines: Micro-Switch trips new improved target with positive setting and release; National Acme solenoid operates Hilliard roll type clutch; Warner electric brake; two Reeves variable speed units control speed of cut and range of feed; alloy steel feed roll shafts run on Timken bearings.

All these fine Brand Names are represented in the Shuster 3AV — 4AV illustrated. There is a Shuster to fit your requirements from .020 to 11/16″.

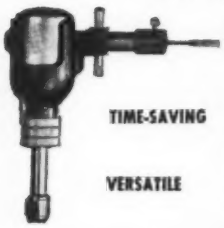
Illustrated *MODEL 3AV* 1/4″ to 1/2″ basic wire, feeds from 76 to 228 feet per minute.
MODEL 4AV 3/8″ to 11/16″ basic wire, feeds from 90 to 180 feet per minute.
Send for free wall size split gauge wire chart from 41 gauge to 7/0.

METTLER
MACHINE TOOL, INC.

150 West Adeline St., New Haven, Conn.
CIRCLE INFORM-A-GRAM KEY NO. 123

any contour,
any detail,
any finish...

THE
Di-Profiler RECIPROCATING HAND MACHINE
does your job faster



TIME-SAVING

VERSATILE

ADAPTABLE

For precision cutting, roughing, finishing of tools, dies, molds. For straight, or irregular surfaces, convex or concave curves—also shoulders, recesses and hard-to-get-at or intricate detail.

Saves hours of tedious hand labor in grinding, filing, scraping, honing or polishing. The reciprocating speed is variable from 0 to 100 strokes per second; and the stroke is adjustable from 0 to 6 mm. (¼ inch). Sturdily built, the Di-Profiler is light; free from vibration.

A complete assortment of efficient accessories and tools is available for every type of work: steel and diamond files, diamond discs, laps, hones, T-C scrapers; also rotary tools including diamond wheels, burrs and points.

Investigate the Di-Profiler—a minor investment that assures savings of time and costs. Ask for a demonstration or price list DST-127.

ENGIS EQUIPMENT COMPANY
Sole authorized distributor for the U.S.
431 S. DEARBORN ST., CHICAGO 5, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 1241

GAY-LEE
CARBIDE "THINSAWS"

FOR SAWING, SLOTTING, SLITTING

For fast, precision sawing, slotting or slitting, use a Gay-Lee "Thinsaw." Even when wafer-thin for delicate work, these saws maintain positive alignment and rigidity for full-depth cutting without run-out. Carbide tips for speed and long life, brazed into a special, patented seat that holds them firmly. Thickness as low as .030", thickness tolerance held to .0001", O.D. 1¼" to 10". For ferrous, non-ferrous, plastics, etc. Any tooth form available. Send details of your problem for recommendation and quotation.

Patented—Manufactured under license.

GAY-LEE COMPANY
CLARION • MICHIGAN

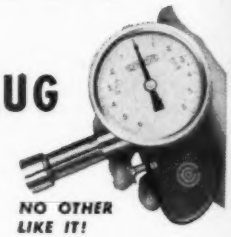
**With Gay-Lee patented construction, brazed teeth with circular seat definitely will not break loose from saw body.*

CIRCLE INFORM-A-GRAM KEY NO. 1242

You enter a new world of precision gaging with

COMTORPLUG

Patented Expanding 2-point Gage graduated .0001" — for holes ⅛" to 10" dia.

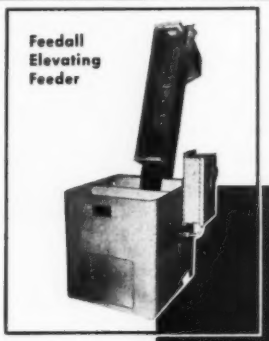


NO OTHER LIKE IT!

WHY
do AUTOMOTIVE TRANSMISSION plants use thousands of Comtorplugs?

FIND OUT!
COMTOR COMPANY
82 Farwell St.
Waltham 54, Mass.
WRITE FOR BULLETIN 50

CIRCLE INFORM-A-GRAM KEY NO. 1243



Feed high-speed production machines automatically with

FEEDALL AUTOMATIC PARTS FEEDERS

YOU NAME the part and the flow rate...a Feedall machine will provide high-speed delivery, feed or transfer of small parts in a fully automatic operation. Versatile Feedalls handle rolling or sliding parts, valve slugs, rings, bars up to 1½" x 30" long, and scores of other high-production pieces.

TYPICAL USES include hopper-load elevating, blade or rotary feeders for centerless grinders, presses, milling machines, heat-treat machines and similar production units.

DETAILS are contained in latest Feedall catalog, complete with estimate data sheet. Write for your copy today.

Feedall
Producers of automatic feeding devices
FEEDALL, INC. • WILLOUGHBY, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1244

faster delivery

FROM YOUR LOCAL INDUSTRIAL DISTRIBUTOR'S STOCK

ACME Dowel Pins

- Standard PINS available in lengths from 3/8″ to 6″—1/8″ to 1″ in diameter. Specials, including pins of stainless steel, quoted on request
- Precision pins, hardened and ground to .0002″ or .001″ over nominal diameter—also available: .002″, .003″, .004″ and .005″ oversize—all diameters .0001″
- Acme Pins are case hardened to 60-62 Rockwell "C" scale and a core hardness of 36-38
- Acme Pins will break before bending or mushrooming

Write for information and prices on standard and oversize dowel pins

ACME INDUSTRIAL COMPANY

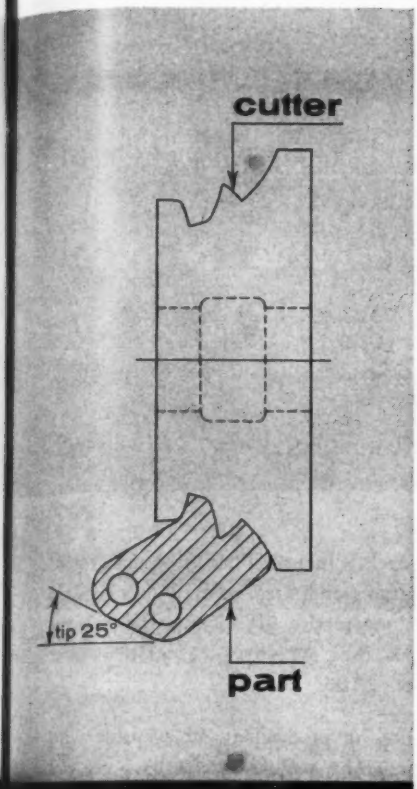
CIRCLE INFORM-A-GRAM KEY NO. 125

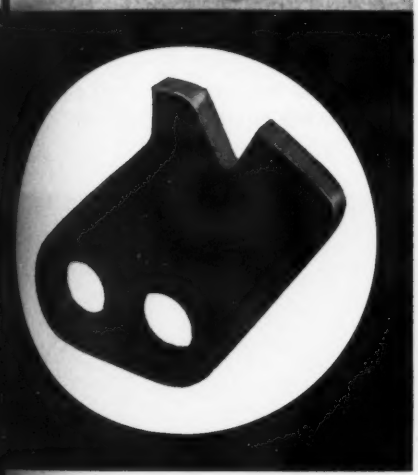
top cutter design
saves 50% in cutter cost,
reduces cutter breakage

BARBER-COLMAN recommends:

a single solid form relieved cutter to replace two former cutters

improved design to increase tool life and reduce cutter breakage





This Barber-Colman unground form-relieved milling cutter takes the place of two milling cutters formerly operated as a gang for milling these lever sectors. The proportions of the cutter were improved by reducing the cutter diameter and increasing the bore diameter. These improved proportions provide greater rigidity in the cutter and in the milling operation. As a result, initial cutter cost has been reduced 50%, and cutter cost-per-piece further reduced through extended tool life and reduced breakage.

The form on the workpiece is located with respect to the cutter axis to allow sufficient clearance behind all cutting edges. In this particular application, the workpiece is positioned at 25° relative to the cutter axis, permitting the manufacture of a one-piece cutter with adequate cutting clearance.

The material in the part is soft steel of maximum machineability. For best cutting efficiency, the cutter was designed with adequate clearance for milling this material. Cutters are 5″ diameter with 1¼″ bore as compared with previous cutters of 6″ diameter and 1″ bore.

Replacement with a single form relieved cutter has simplified cutter resharpening and reduced cost-per-piece. All Barber-Colman form relieved cutters are index sharpened across the face of the teeth. Cutters are simply and easily resharpened on conventional equipment or Barber-Colman automatic hob and cutter sharpening machines.

With Barber-Colman improved cutter design, pieces are milled at the rate of 3½″ per minute feed, and 150 R.P.M. cutter speed. Tool life averages 3,000 pieces per sharpening.

If you are seeking ways to improve your milling cutter efficiency, consult Barber-Colman cutter engineers. Their skill and experience in applying advance cutter design features will help to solve your milling problems.

BARBER-COLMAN COMPANY

81012 ROCK STREET • ROCKFORD, ILLINOIS

Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines

BARBER COLMAN

CIRCLE INFORM-A-GRAM KEY NO. 127

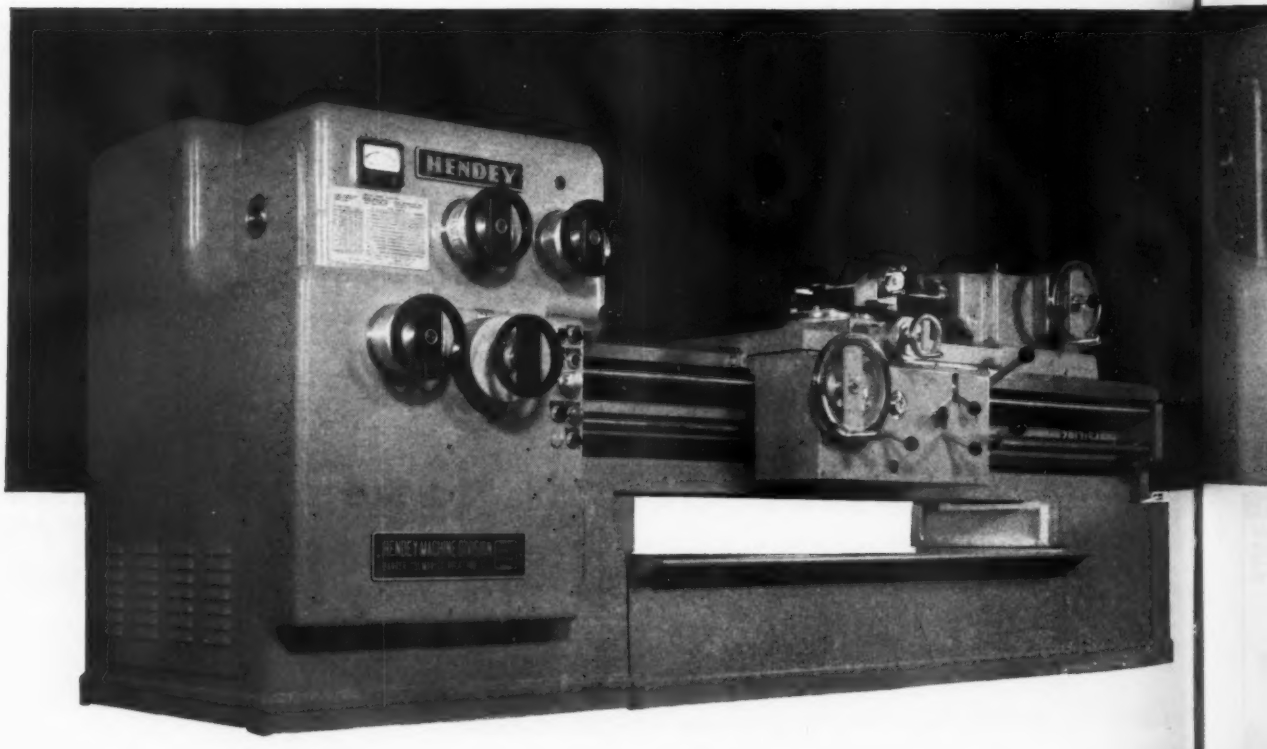
get functional simplicity with BARBER-COLMAN'S NEW Hendey 32-speed lathe . . .

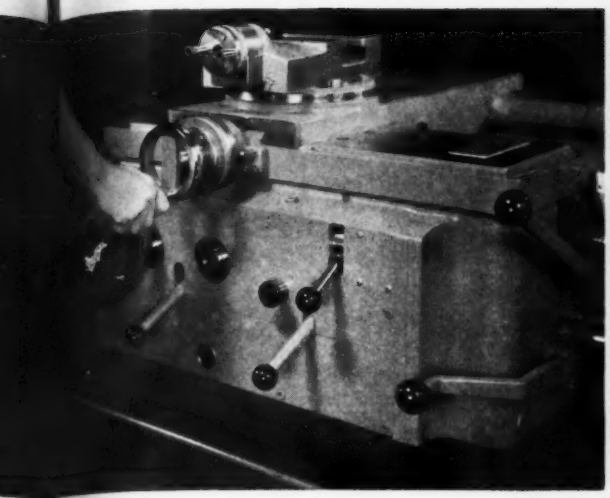
Here is a precision production lathe by Hendey designed to give you *functional simplicity* . . . streamlined to cut jobs to simple, fast steps.

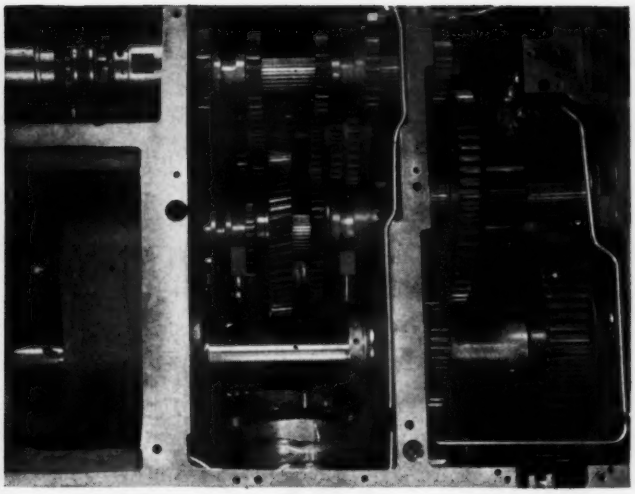
It's all new. There is no other lathe like it for efficient toolroom or production turning. *Functional design* provides maximum ease of operation and gives you more quality for the money.

This new Hendey lathe has the rigidity needed for low-cost machining with carbides and ceramic tools. The extra-heavy bed casting, made of dense wear-resistant semi-steel, is induction-hardened and ground on all way surfaces and stress-relieved to safeguard accuracy over long service life. The carriage has a full 30 in. span over the ways — wider than most lathes of the same size.

Two models now in production and available with 10, 15, 20, or 25 hp motor. No. 2013 gives you 21⅜ in. swing over the bed ways and 13 in. over the cross slide — No. 2516 gives you 25 in. over the bed ways and 16 in. over the cross slide. Call your Hendey dealer or write the factory for literature.





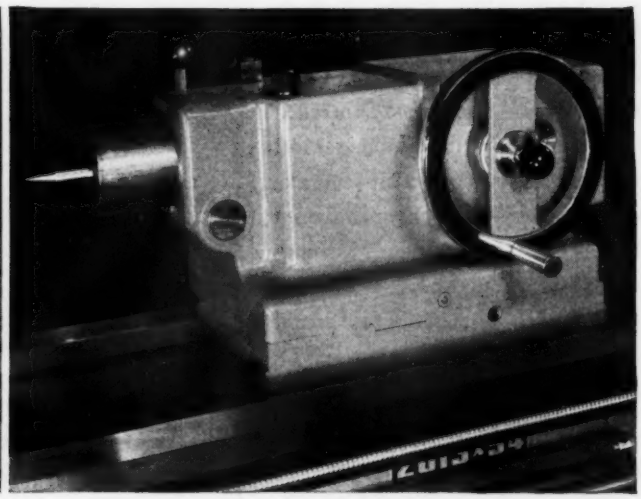


Timesaving control features
Quick-change threads per inch range from 2 to 120, feeds from .0015 in. to .091 in. per revolution. Special high-speed reversing unit, with reversing lever on apron. Independent lead screw. Precision automatic stop. Built-in thread-chasing dial. Positive overload clutch. Ball-thread-chasing stop. Automatic, filtered lubrication to half nuts.

Quick speed changes
Only two dial-type handwheels, designed for quick resetting, mechanically actuate all 32 speed changes. Maximum speed up to 2000 rpm. Two handwheels on gear box control 66 quick-change thread and feed changes. Electrical push-buttons, selector switches, and horsepower consumption meter conveniently located on gear box.

32 speeds through gearing
Hendey's headstock and feed gear mechanism are totally enclosed. Power is through one heavy-duty multiple-disc clutch. Shaved and flame-hardened spur gears are mounted on involute splines. Filtered spray system lubricates all gears and bearings in the headstock, feed box, and change gear compartment.

Two-speed tailstock
Tailstock has a two-speed spindle. Hardened and ground tang-slotted spindle is 4½ in. in dia., has a full 10 in. extension, and is graduated in 1/16 in. — handwheel dial in .001 in. Rugged 400 lb tailstock, on four adjustable rollers, is positioned easily. Bearing surfaces on both sides, through whole length of tailstock base. Induction-hardened and ground ways.



Hendey **machine division**
BARBER-COLMAN COMPANY
127 Loomis St., Rockford, Illinois

BARBER COLMAN ®

CIRCLE INFORM-A-GRAM KEY NO. 129

FREDDY FEDERAL SAYS:

from prototype to product perfection

SHORT-RUN STAMPINGS may be your answer

- For Cutting Costs
- For Expediting Experimental Work
- For Speeding Pilot Plant Operation
- For Making Quick Product Changes
- For Meeting Time and Cost Budgets
- For Replacement Parts on Obsolete Equipment
- For Small Orders

SAVE UP TO 80%

of the cost of conventional tooling methods with Federal's "Controlled Tolerance" short run stampings. Meet time and cost factors with accurate, quality stampings of any material up to 10"x14"x¼" thick . . . any quantity from 2 pieces to 10,000. Send your print, sketch or part for a Federal Analyzed Quotation. Prompt service and prices.

FREE CATALOG

Tells where and how you can save money using Short Run Stampings. Gives design tips that reduce stamping costs. Write for catalog 201 today.

Federal TOOL & MFG. CO.
3641 Alabama Avenue
Minneapolis 16, Minn.
QUALITY STAMPINGS IN SMALL QUANTITIES

CIRCLE INFORM-A-GRAM KEY NO. 1301

Specify RITOLOY, and Get carbide wear at 1/3 the cost!

For the longest gage wear at the lowest cost specify Ritoloy. Independent laboratory tests (report sent on request) and actual production use have proved that Ritoloy will give a service life equal to that of carbide or flame-plate. And it costs much less, in fact, only about one-third as much.

Ritoloy gage surfaces are made of an extremely hard, wear resistant nickel alloy. They have a low coefficient of friction and are non-magnetic. Both Ritoloy plain plug and ring gages are available, and are made entirely and exclusively within our own plant.

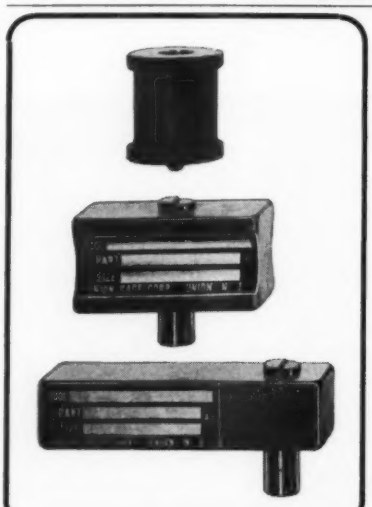
FREE: INSTRUCTIVE GAGE PRIMER

Good basic text on gage practices involving plain and thread plug and ring gages. Explains and prices Ritoloy gages too. Request the Rite-O Gage Primer and Price List today.

RITE-O TOOL & GAGE COMPANY
321 West Ten Mile Road • Hazel Park, Michigan
Rite-O

Precision manufacturers of plain and threaded plug and ring gages, indicator depth gages, and special gages and fixtures

CIRCLE INFORM-A-GRAM KEY NO. 1302



STANDARD FLUSH PIN GAGES

AVAILABLE FOR IMMEDIATE DELIVERY. Over one hundred and fifty varieties standard, bar, barrel and indicator type flush pin gages. Standard gages can fill 90% of your depth gaging problems.

Write for eight page pocket size specification and price list booklet—no obligation of course.

UNION GAGE CORPORATION
711 Lehigh Ave., Union, N. J.
Murdock 6-9150

CIRCLE INFORM-A-GRAM KEY NO. 1303

economically priced press room equipment

DURANT Automatic Stock Reels

Operates by natural spring of uncoiling stock. Priced from $75.00. Nine other models of stock reels in vertical, horizontal, motorize or automatic types for all applications.

Manufacturers of Stock Reels, Roll Feeds, Straighteners, Scrap Choppers, Die Pullers, Foot Presses, Coil Cradles, Press Guards, Stock Oilers.

WRITE FOR NEW FREE CATALOG

DURANT Tool Supply Co.
PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 1304

Magnetic Base Indicator holders

Erick
Magna Holder
Model 2008
Only $6.50

See your dealer or write for catalogue 755 on the most complete line of magnetic base units & access. mfg'd.

CULLEN MFG. CO., RACINE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 1305

GROWING PAINS

Construction is expected to begin on a new Lebanon, N. H., plant for the **Split Ballbearing Division** of **Miniature Precision Bearings, Inc.** The $350,000 plant will cover approximately 30,000 sq ft. This will more than triple the floor space of the present Split Ballbearing facility.

◆

Plans to erect a new **Chrysler Corporation** automobile assembly plant in the St. Louis area were announced by the company. The new plant, which will cover 1,300,000 sq ft, is scheduled for completion in the spring of 1959.

◆

Construction of a new manufacturing plant at Danville, Ill., for the **Hyster Company** is under way. When the entire plant is completed it will house all of Hyster's Danville operations including sales and administrative offices, service facilities, and manufacturing.

◆

United States Drill Head Company is constructing the second building in their project, an 11,000 sq ft structure which will accommodate the Standard Pattern Division of the company.

◆

A $2,000,000 precision instrument ball bearing plant in Danbury, Conn., is being constructed by **The Barden Corporation.** When completed, the new 125,000 sq ft plant will have sufficient capacity to replace Barden's main plant and provide expanded facilities to meet increased customer demands.

◆

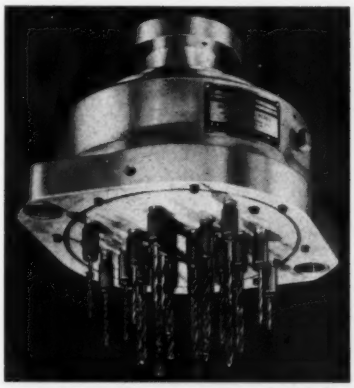
CIBA Co., Inc. has broken ground for a new epoxy resin plant and development laboratories at Toms River, N. J. The new plant will replace the present capacity of CIBA's Kimberton plant where all of CIBA's resin and plastics activities are now centered.

◆

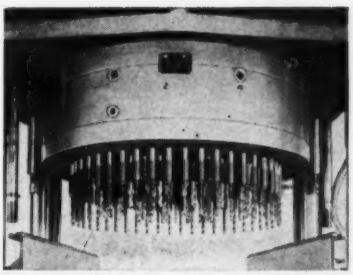
A 50,000 sq ft light manufacturing plant at North Manchester, Ind., is being planned by **Controls Company of America.** The building will house operations transferred from its present Spring Valley, Ill., facilities.

The Whole Answer to Your Hole Problem . . . .

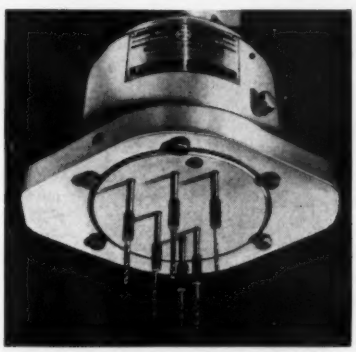
it's Zagar GEARLESS DRILL HEADS



Any hole pattern—on any center up to 1½" dia.



Up to 1200 holes can be drilled IN ONE PASS.



The Zagar "66" gearless drill head drills 6 holes up to 3/16" dia.

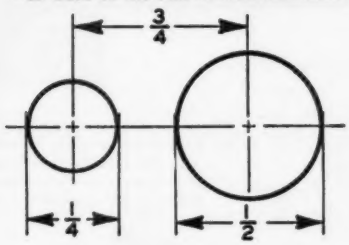
ZAGAR SAYS: "Use more spindles— NOT more machines."

Have YOU heard the ZAGAR story?

Briefly:

Any number of holes at one pass—1200, for instance.
Any hole pattern, no matter how intricate.
Any machinable material.
Any hole diameter up to 1½", or varying diameters on all centers up to sum of two hole diameters involved.

—as close as the sum of hole diameters



Emphasized: standard Zagar Gearless Drill Heads can be installed on your present presses. If you prefer, Zagar engineers will design the right tooling for the "hole" job. Send sample parts and profit by Zagar's extensive drilling background.

Get Zagar's Engineering Manual T-12

ZAGAR INCORPORATED

23894 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

CIRCLE INFORM-A-GRAM KEY NO. 131

C Punching holes in the work with the first stroke of press ram. No aligning of punches and dies. The same group of units may be used in unlimited setups for greater economies.

WRITE FOR FULLY-ILLUSTRATED CATALOG *TODAY*

PUNCH PRODUCTS *Corporation* 3804 HIGHLAND AVE., NIAGARA FALLS, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 132

ROCKWELL-BUILT

new DELTA 20" drill press

...fills need for low cost production tooling

Delta's great new 20" Drill Press was designed, engineered and built to fill industry's growing need for *flexible* production tooling. Here is why it can save you money by handling jobs normally requiring machines *costing four and five times as much:*

BIG MACHINE CAPACITY—You get full 6" spindle travel and long 5½' high column for *extra* spindle to table capacity, backed by massive construction and rugged power to match! It's a real production tool for jobs ordinarily demanding big, expensive special-purpose machines.

POWER TOOL VERSATILITY—New Delta 20" can be used singly for a wide range of production jobs, yet readily adapts to work in combination with special-purpose machines. And you can move it *where you need it* to reduce materials handling, save costly man hours.

LASTING PRECISION—Delta's 30 years of unmatched quality power tool experience give you precision and performance features that assure exacting tolerances (and lower maintenance) through years of hard, continuous operation.

SEE THE ENTIRE DELTA DRILL PRESS LINE: Get all the facts about the new Delta 20" plus other new and improved Delta Drill Presses. Compare for quality, for precision, for value—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

Send coupon for all the facts!

DELTA ROCKWELL

another product by **ROCKWELL**

Delta Power Tool Division, Rockwell Manufacturing Co.
622M N. Lexington Ave., Pittsburgh 8, Pa.

- ☐ Please send complete catalog on entire Delta Drill Press line.
- ☐ Please send booklet: Delta Power Tools Teamed with Machine Tools.
- ☐ Please send names of my nearest Delta Dealers.

Name_____ Title_____

Company_____

Address_____

City_____ County_____ State_____

CIRCLE INFORM-A-GRAM KEY NO. 133

More Useable Carbide For Your Money
More Life For The Cutting Edges
Positive Locking Clamp
Quick and Accurate Indexing

Pentagon Indexable

30° lead angle

25% more cutting edges

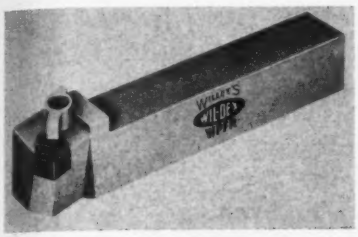
WILLEY'S CARBIDE TOOL COMPANY

1340 WEST VERNOR HIGHWAY · DETROIT 1, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 134

PENTAGON INSERTS INCREASE TOOL LIFE

Ten cutting edges are a feature of Pentagon solid carbide inserts, which cost no more than a square insert with eight edges. Tool life is increased because the Pentagon permits a 30° lead angle, which reduces shock to the tool nose and allows the tool to enter the cut more gradually and away from the nose of the insert. With the reduced 12° cutting



edge angle, a greater volume of carbide backs up to the cutting edge giving greater edge strength. Other features include positive locking and ease of indexing. For details, contact Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, or —
Circle Inform-A-Gram No. D1.

THREAD METROLOGY LABS PLANNED BY SPS FOR '58

Plans for a three-city network of screw-thread measuring laboratories, to help Industry with fastener fit and gaging problems, are being completed by Standard Pressed Steel Co. The three identical labs will open early next year at the SPS plant in Jenkintown, Pa., The Cleveland Cap Screw Co. in Cleveland, and the Cooper Precision Products plant in Los Angeles. The latter two are subsidiaries of SPS.

Increasing demands for mechanical precision in the nuclear and missiles age, as well as the necessity to reduce production losses resulting from "needless" fastener assembly problems, are reasons for the creation of the labs, says H. Thomas Hallowell Jr., SPS president.

Basic services to be offered include analyzing fastener fit problems, checking and setting screw-thread inspection gages with highly accurate equipment, and setting up reliable inspection gaging systems in conformance with recognized thread standards.

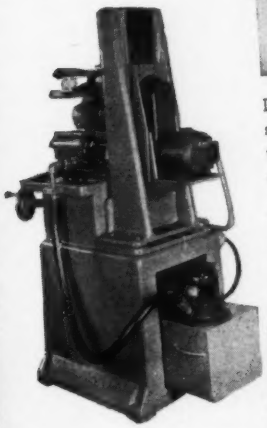
The temperature and humidity controlled labs will cost an estimated $300,000. Each one will have complete equipment for precision meas-

DALZEN

THREAD GRINDER

- AVERAGE SET-UP TIME 30 MINUTES!
- SAVES FLOOR SPACE!
- LOW COST!

Excellent for tool room and production Thread Grinding. Easily set-up from job to job! Has built-in relieving attachment as standard equipment for grinding of taps. This remarkable machine may also be used to grind angles, grooves and surfaces where concentricity is an important factor!



Dresser and wheel head are self-compensating. Size of work is automatically maintained after dressing of wheel regardless of how much is dressed off.

The grinding and regrinding of thread rolls up to 3" in diameter and thread milling cutters can also be ground with special attachment.

Photo shows just a few of the many jobs done on the DALZEN THREAD GRINDER.

2 in 1 COMBINATION
CENTER GRINDER AND DRILL PRESS

A drill press and center lapping machine at less than the cost of many single purpose center grinders! In addition to savings on equipment costs, the Dalzen "2 in 1" permits maximum man-hour production thereby keeping your unit cost at a minimum!

1 SIMPLE OPERATION CHANGES CEN.ER GRINDER TO DRILL PRESS

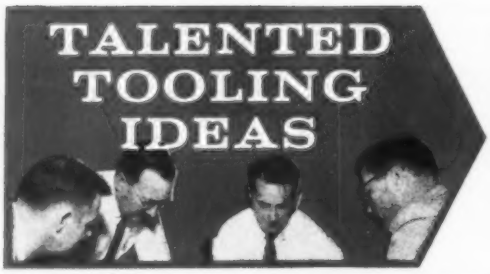
Center grinder to drill press or drill press to center grinder in a matter of seconds! Simply unlock clamping handle and swing diamond dresser in or out of position! Photo at right shows center grinder at work.

A full 43" capacity from base to spindle . . . dresser adjustment from 20° to 100° included angle . . . drills to center of 15" circle . . . maximum lapping stone dia. 3".

WE ALSO SPECIALIZE IN THREAD ROLLING DIES AND THREAD HOBS LITERATURE ON REQUEST

DALZEN MANUFACTURING CO.
4600 BREE ROAD DEPT. TP-12
ST. CLAIR, MICHIGAN

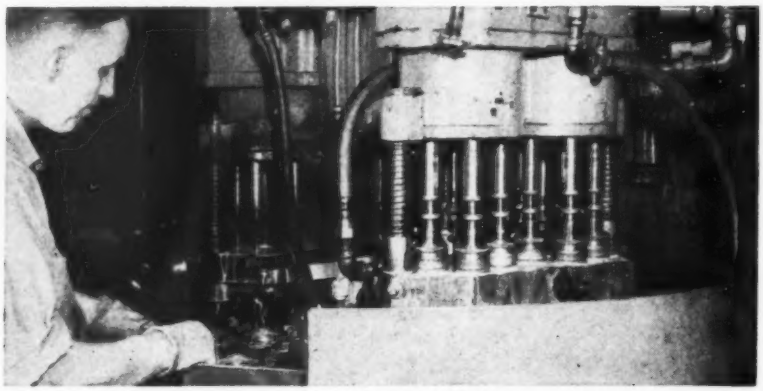
CIRCLE INFORM-A-GRAM KEY NO. 135



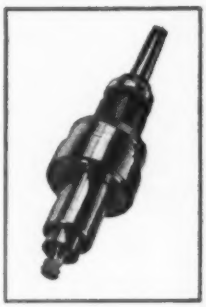
FROM
SCULLY
JONES

SCULLY-JONES AND CO., 1913 SO. ROCKWELL ST., CHICAGO 8, ILL.

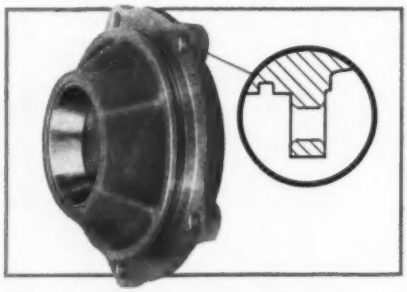
Automatic recessing tools simplify back-chamfering operation on multiple-spindle drill!



Here's how Baker Machine Company designed a simpler machine for drilling, reaming, and chamfering five holes in each of two parts for the Ford Chassis Parts Plant, Sterling, Michigan.



Retainer and bearing cup assembly forgings are drilled and reamed in this four-station machine—then Scully-Jones Automatic Recessing Tools (five in a cluster for two different size bolt circles) feed down to chamfer top and bottom edges of the holes. Chamfering cutters easily fit inside the reamed holes, and when the stop collar of the recessing tool contacts the face of the fixed pilot bushing, radial feed is automatically actuated and controlled by a lead cam within the tool.



Handling of the piecepart has been minimized. The operator just loads and unloads two different parts. Scully-Jones Recessing Tools eliminate the need for turning the work to deburr and chamfer bottom edges. Perhaps you can make major capital equipment savings by using Scully-Jones Automatic Recessing Tools for doing intricate machining operations on drill presses, radial drills, turret lathes, and chucking machines. Adjustments for controlling location and depth of cut are simple, fast, and accurate. Eccentric cam action produces a positive feed. Positioning of the cutter and the cutting cycle itself are fast, efficient operations that assure a high rate of production. Changing tool bit holders or circular form cutters easily adapts your S-J recessing tool to do complex operations, like cutting reliefs, grooving, chamfering, back-facing and counterboring, necking, boring, or a combination of these.

Write for Bulletin 10-50 describing typical recessing jobs. You'll get a complete check list for investigating possible applications in your shop.

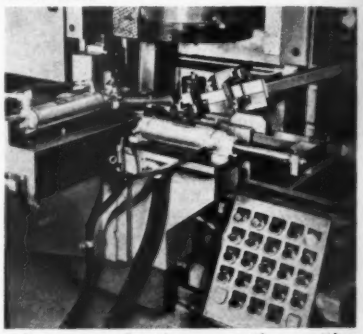
CIRCLE INFORM-A-GRAM KEY NO. 136

urement of all screw thread elements and for inspecting the thread-forming tools themselves, if necessary. This includes precision machines for direct measurement of thread dimensions to the nearest 0.00001", primary reference standards of greater precision for calibrating the machines, optical comparators for studying screw-thread details, and profilometers that measure surface smoothness as close as millionths.

AUTOMATED PARTS LOADER SWINGS CLEAR FOR TOOL CHANGING

A new automated parts loader that feeds parts at any rate up to 100% machine efficiency, yet swings clear of the machine for easy tool change, has been developed.

The loader, built by the Michigan Tool Company, feeds parts two-at-a-time from a two-position (90° spacing) index dial. Parts enter the feeder from an entrance chute with one part dropping into a recess while mechanical fingers momentarily retain the second part. When released, the second part stacks on top of the first. From this point both parts are transferred to the index dial, indexed, machined, and ejected as a unit.



In one production operation, cutting a 36-tooth involute spline on a 0.580" face width of a clutch hub, a Michigan 1853 Shear-Speed equipped with this new loader produces 180 parts/hr. Automatic cutting cycle for both parts is 32 sec. Loading time for both parts, at 100% efficiency, is only 8 sec. The loader can be adapted to all Shear-Speed machines in the 1800 series.

The possibility of the automating devices interfering with tool changes and service requirements is avoided with this new loader because of its swing-out arrangement. The entire mechanism — feeder, index table, and index slide — is pivot mounted so that it can be swung completely clear of the machine. Pin-locked stops assure positive alignment.

Some of COLONIAL'S Standard Lines:

Ram-Press — Versatile broaching machines at reasonable cost. Four models in 4, 6, and 10-ton capacities with 24 and 36-inch strokes. Ask for Bulletin RP.

Universal Horizontals — Designed to do both internal and surface broaching operations. Models include sizes of 6, 10, and 15 ton with strokes of 54, 60 and 72 inches. Request Bulletin HS.

Utility Press — Low-cost, high-quality machines available in a range of sizes from 4 ton to 10 ton in a variety of strokes. For details write for Bulletin PB.

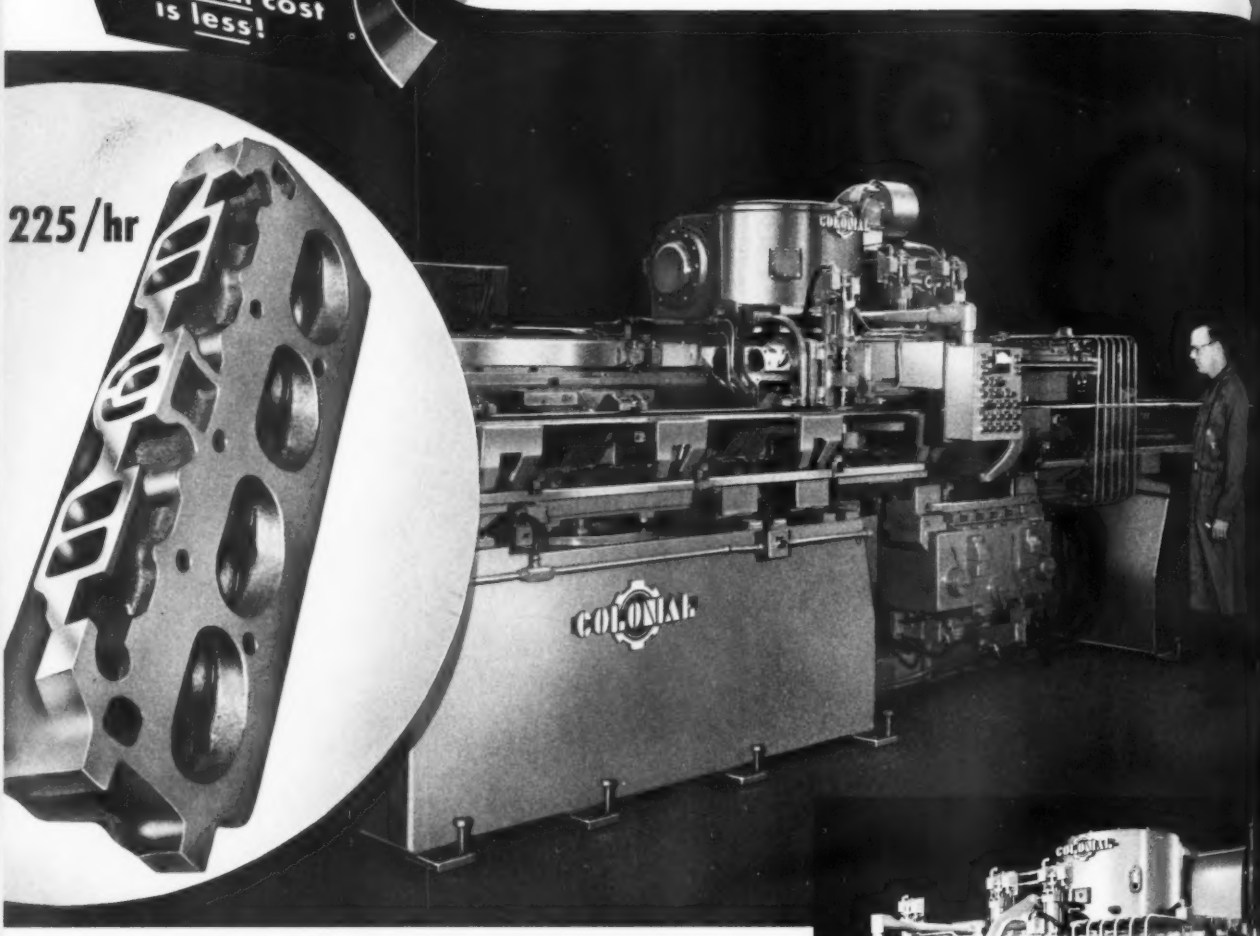
"Junior" Press — Push or pull assembly and broaching operations. 1, 2 and 4-ton sizes in bench and floor types. Get Bulletin VJ.

You Can Broach Most Parts on Standard COLONIALS

Broaching is the fastest method of accurate metal removal available to industry today. No matter what the part, always ask yourself "can it be broached?" You can use broaching on all kinds of jobs—internal and external, simple and complex, on big or small parts in all kinds of metals in large or small quantities. And to slash your capital investment, use a broaching machine from COLONIAL'S standard line. Send us your part prints. We'll tell you which broaching machine will cut your costs the most on quantities you need. No obligation.

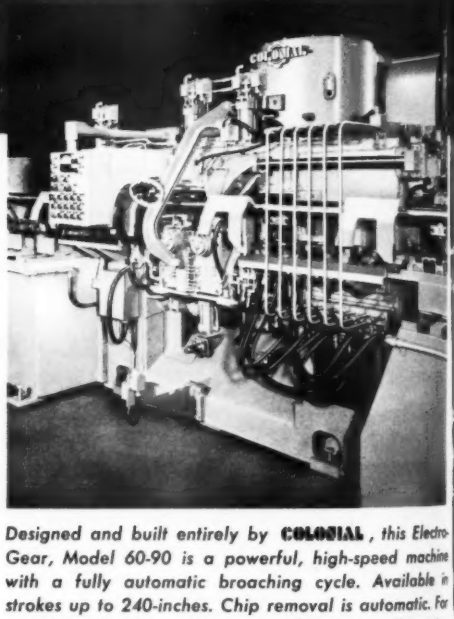
COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

WITH COLONIALS
the final cost is less!



Automated Horizontals for Faster Surface Broaching

Automated broaching is one of **COLONIAL'S** strong points—for with automation you can get even higher production efficiencies from standard broaching equipment. A good example is shown here—an automated version of the popular **COLONIAL** ElectroGear horizontal broaching machine. It broaches 225 cylinder heads per hour at 130 sfpm to ± 0.001 in. tolerance using carbide broaches. Loading, machining, and unloading is completely automatic. Where costs are important, **COLONIAL** surface-broaching methods like this are becoming evermore widely used. Keep up with the latest applications. A letterhead request for BROACHING NEWS makes it easy. We'll send it regularly.



Designed and built entirely by **COLONIAL**, *this ElectroGear, Model 60-90 is a powerful, high-speed machine with a fully automatic broaching cycle. Available in strokes up to 240-inches. Chip removal is automatic. For complete details on these remarkably smooth-running machines, write for Bulletin HM-56.*

COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

SHOP AIDS

Silver Brazing Preforms are presented in a second edition of a 16-page booklet which describes uses of Silver Brazing preforms. Specifications of silver brazing alloys are given in chart form and advantages and special applications are also included. Illustrations and descriptions of typical parts are given. For more information write to Lucas Milhaupt Engineering Co., Cudahy, Wis., for a copy of "The Path to Better Brazing . . . ", or —
Circle Inform-A-Gram No. C1.

Steam Atmosphere heat treating and its effect on high speed tool steel, cast iron, etc. is discussed in the catalog. This heat treatment is being used to lengthen life of high speed steel cutting tools, strengthen powdered iron parts, and seal and protect cast iron. Benefits achieved with steam treating are cited. Copies of Catalog TD-2-620 are supplied by Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44, or —
Circle Inform-A-Gram No. C2.

Over 65 Different Applications in bending tubing, pipe, extrusions, and rolled sections are explained and illustrated in a catalog. A discussion of basic bending principles includes draw bending, compression bending, roll bending, and stretch bending and illustrations accompany the material. Descriptions, specifications, and capacities of the machines and accessories are also given. Pines Engineering Co., Inc., 601 Walnut St., Aurora, Ill., is offering the catalog, or—**Circle Inform-A-Gram No. C3.**

Motive-Power Battery maintenance and repair is described in a revised edition of the "Battery Users Manual." The 44-page book includes over 60 photographs, diagrams and tables, to review battery theory and construction, demonstrate proper battery selection, illustrate charging methods and equipment, demonstrate battery testing techniques, and to present correct battery room layout. Copies of Bulletin GB-1599A may be obtained from Gould-National Batteries, Inc., Trenton 7, N. J., or—**Circle Inform-A-Gram No. C4.**

An Electric Brake designed for fail-safe applications is presented in a 36-page illustrated report. It contains sections of explanations of operations, selection factors, torque characteristics and control. The comprehensive report also includes charts, diagrams, and pictures. Obtain copies of Technical Report WEB 6293 from Warner Electric Brake & Clutch Co., Beloit, Wis., or —
Circle Inform-A-Gram No. C5.

"Eyelet Setting Data & Equipment" is the title of a booklet published by Edward Segal, 72 Spring St., New York 12. This booklet discusses the problem of eyeletting and eyelet attaching machines and setting tools. There are diagrams of the machinery and specifications of each unit. Copies of the bulletin are available from the company, or —
Circle Inform-A-Gram No. C6.

"How to Get Better Welds" is a revised edition of Welders' Pocket Guide containing 60 pages of useful welding information. The booklet gives information on metals and electrodes, four essentials of proper welding procedures, the fillet weld, types of joints and typical welding positions, etc. Write to Hobart Brothers Co., Troy, O., for copies of Booklet EW-201, or —
Circle Inform-A-Gram No. C7.

"Residual Stresses in Cold Finished Steel Bars and Their Effect on Manufactured Parts" is the title of a pocket-size book. Specific subjects covered range from residual stresses in cold drawn, ground, turned and heat treated steels, to discussions of fatigue, cracking, machinability, tolerances, and corrosion. Request copies from La Salle Steel Co., 1420 150th St., Hammond, Ind., or —
Circle Inform-A-Gram No. C8.

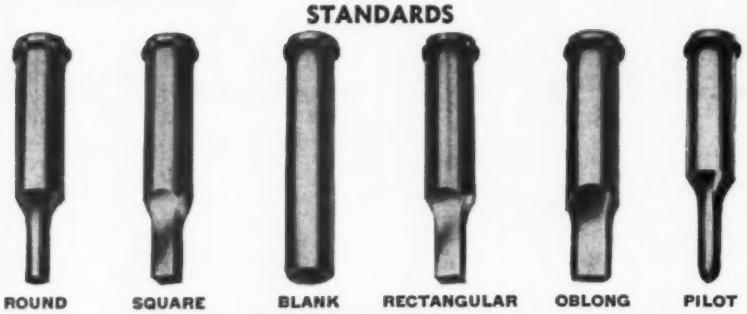
Stainless Steel government specifications are among the statistics listed on a chart. The chart shows chemical analysis requirements for the most frequently used military, Air Force-Navy, aeronautical, and federal specifications. It also lists specified forms (bars, wire, etc.) and nearest corresponding SAE, AISI, and AMS type numbers. To get your copy write to Peter A. Frasse & Co., Inc., 17 Grand St., New York 13, or —
Circle Inform-A-Gram No. C9.

Nylon Application literature for various industries is now available from The Polymer Corp. of Pennsylvania, 2140 Fairmont Ave., Reading, Pa. The literature contains many case histories designed to assist engineers in applying nylon parts in their industries. Information on chemical, electrical, machine tool, food, textile, instrument, and other fields is also included.
Circle Inform-A-Gram No. C10.

The Cost and Time-Saving Benefits of tubing over other forms of stock is explained in "A Guide to the Choice of Seamless Mechanical Tubing." Engineers associated with the design, fabrication or production of equipment involving the use of hollow cylindrical parts, will benefit from the information furnished in Bulletin TB-340A. Included are descriptions of how seamless tubing is manufactured and finished, and the differences in dimensional tolerances, costs, machinability, and surface finishes of various types of seamless mechanical tubing. For copies of the bulletin write to Tubular Products Div'n, The Babcock & Wilcox Co., Beaver Falls, Pa., or —
Circle Inform-A-Gram No. C11.

RING PUNCHES AND DIES

STANDARDS



ROUND SQUARE BLANK RECTANGULAR OBLONG PILOT

TYPE R DIES

SLUG EJECTOR PUNCHES

HIGH SPEED BEVEL & SHOULDER HEAD QUILLS

TYPE R DIE TYPE P DIE

COMPLETELY INTERCHANGEABLE
SHIPMENTS FROM STOCK
CHOICE OF STEELS
HIGH QUALITY
LONG LIFE
LOW COST

NEW!

PUNCH & DIE RETAINERS

Tough alloy retainers accurately machined for Ring Punches and Dies. Ease of mounting saves time and money.

SPECIALS

Send prints or sketches for quotation on your requirements. Prompt deliveries—reasonable prices.

WRITE FOR ILLUSTRATED CATALOG 105

RING PUNCH & DIE, INC.

19 FENTON PLACE JAMESTOWN, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 1401

HARDENED and GROUND HSS BLANKS

Any decimal diameter — any length. Mirror finish surface to gage tolerance.

Many uses —

—core pins, punches, gages, ejector pins, insert pins, special tools, etc. — Quick delivery.

Write or phone DRexell 6-4223 for price list D-3

WILLIAM T. HUTCHINSON CO.
53 Brown Ave., Springfield N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1402

CONTRACT TOOLING AND PRODUCTION

Illinois

DRESEL-BETZ CO.
Belleville, Ill.
Designers and Manufacturers of Tools, Dies, Jigs, Fixtures, Metal Stampings,

Michigan

DAVIS TOOL and ENGINEERING CO.
19250 Plymouth Road, Detroit, Michigan, VErmont 5-6000. Tools and Dies, Special Machinery, Sheet Metal Stampings and Assemblies.

Ohio

CLEVELAND UNIVERSAL JIG COMPANY
13404 St. Clair Ave., Cleveland, Ohio.
MU 1-2800
DESIGNERS AND BUILDERS
Jigs and Fixtures Special Machines
Production Engineering
Complete Plant Routing and Tooling

GENERAL DIE & TOOL CO.
2067 W. 55th St., Cleveland, Ohio
WO 1-4736
Dies, Tools, Jigs, Fixtures, Light Stampings, Special Machinery Manufacturing.

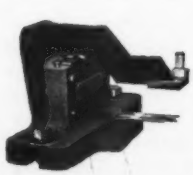
THE INDUSTRIAL MACHINE CO.
1436 East 47th St., Cleveland, Ohio
Founded in 1908. Builders of Special Machinery. General Machine Work.

KIFFER TOOL & DIE CO.
5601 Tillman Avenue, Cleveland, Ohio, WOodbine 1-2440 & 1-2441. Manufacturers of Special Machinery, Tools, Dies, Jigs, Fixtures, Swiss Jig Boring

NOBLE & STANTON, INC.
998 Broadway, Bedford, Ohio, Bedford 2-2800. Tooling, Short Run Production and Machined Parts for Automation

Pennsylvania

MEDAL MANUFACTURING CO.
328 Vine St., Sharon, Pa. Machined parts, complete machine assemblies, special machinery. Send us your prints for quotes.



New Low Cost
AUTOMATIC SCRAP CHOPPER
3" wide $69.00
6" wide $95.00
12" wide $195.00
Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1403

HIGHER SPEEDS! FASTER GRINDING!

kipp

AIR GRINDERS

Model JA
50,000 R.P.M.
$42.00
IN U.S.A.

Weight 12 ounces; length 6¾ inches; chuck size ⅛ inch. Wheel guard removed for better illustration.

The RPM's stay up while grinding . . . not only when the grinder runs idle. That means better work—longer wheel life.

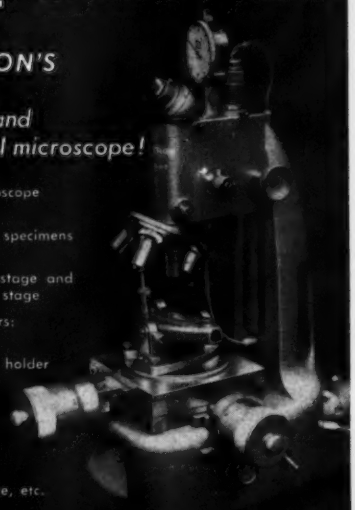
High speed grinding with small wheels was a Madison-Kipp development of the late twenties. It was born out of a pressing need in our tool room. Because tool room grinding problems are universal, we believe it will pay you to utilize Kipp grinders in your tool room as generally as we do in our own.

kipp

MADISON-KIPP CORP.
212 Waubesa St. • Madison 10, Wis., U.S.A.
CIRCLE INFORM-A-GRAM KEY NO. 1411

MEASURE IN 3 DIMENSIONS TO 0.0001"

with UNITRON'S Combination Toolmakers and Metallurgical microscope!



- Direct reading from microscope screws and dial indicator
- Examines polished metal specimens at 30X, 100X, 400X, etc.
- Ball bearing rectangular stage and calibrated circular rotary stage
- Three separate illuminators: substage, surface, vertical
- Inclinable work and tool holder
- Accessories include viewing screen for contour projection and optical comparison, eyepiece scales for measuring screw threads, diameters, metal grain size, etc.

Even the smallest shop can rapidly pay for this versatile instrument in time and materials saved. UNITRON Model TM, with all its features, costs about the same as the lowest priced, simple shop microscope. .....fob Boston only $1050

Write for Bulletin TM.

UNITRON INSTRUMENT DIVISION OF UNITED SCIENTIFIC CO.
204-6 Milk Street • Boston 9, Mass.
CIRCLE INFORM-A-GRAM KEY NO. 1412

GEORGE L. DETTERBECK CO. SINCE 1911

World's Largest Exclusive Manufacturer of
SCREW MACHINE TOOLS!

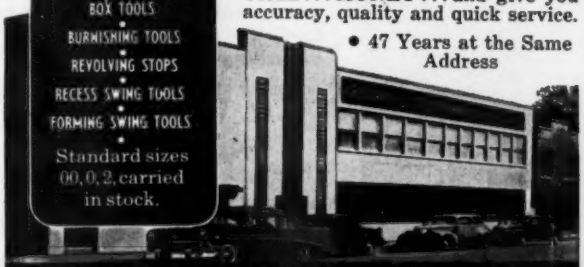
CUTTING CAMS
HIGH SPEED STEEL AND CARBIDE FORM TOOLS
SPECIAL CUTTING TOOLS
SPLIT DRILL BUSHINGS
CROSS SLIDE KNURL HOLDERS
TOOL BITS
BOX TOOLS
BURNISHING TOOLS
REVOLVING STOPS
RECESS SWING TOOLS
FORMING SWING TOOLS
Standard sizes 00, 0, 2, carried in stock.

We specialize in one thing only . . . designing and making SCREW MACHINE TOOLS!

47 years experience goes into every tool we make. They come to you ready for use . . . Precision design . . . Skilled workmanship . . . Finest materials.

Our extensive facilities save you TIME . . . MONEY . . . and give you accuracy, quality and quick service.

• 47 Years at the Same Address



GEORGE L. DETTERBECK CO.
1871 Clybourn Avenue • Chicago, Illinois
CIRCLE INFORM-A-GRAM KEY NO. 1413

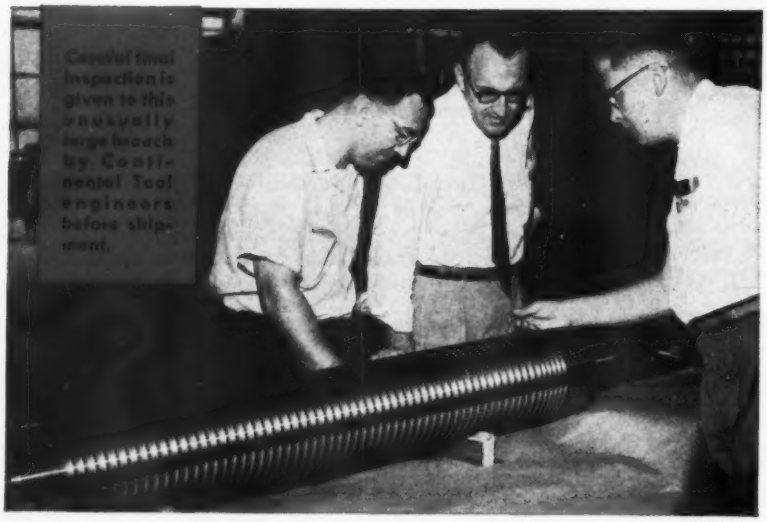
Keep Informed • CATALOGS BULLETINS • SPECIFICATIONS

PUBLICATION

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

A Conveying System, The Magne-Carrier, eliminates clamps, hooks, and other positioning and attaching methods, and employs magnetic principles for conveying parts through processing operations. Other advantages and information is contained in a bulletin, including sizes and applications. The bulletin is available from Multifinish Mfg. Co., 26341 W. Eight Mile Rd., Detroit 19, or —
Circle Inform-A-Gram No. B1.

Air and Hydraulic Cylinders are highlighted in a 12-page catalog released by Petch Mfg. Co., 463 York St., Detroit. It includes complete information and engineering specifications regarding five types of cylinders. These five types come in sizes from 1" to 10" and special cylinders to 16" bores are available. Write to the company for copies of Bulletin 7a, or —
Circle Inform-A-Gram No. B2.



57 15

Ever see a broach this large before?

This mammoth broach accurately broaches involute splines in steel for a builder of earth-moving equipment. Built by Ex-Cell-O's Continental Tool Works Division, it called for a series of critical manufacturing operations, including a difficult hardening process applied to the shell main body . . . another good example why it pays to call in your local Ex-Cell-O Representative when you face an unusual broaching problem.

Just one of the many other types of broaches built by Continental.

Continental CTW TOOL WORKS

Division of Ex-Cell-O Corporation
DETROIT 32, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 142

A Line of Roll Pointing machines for pointing non-ferrous wire and rod preparatory to drawing through a die is highlighted in a bulletin. It covers both the pedestal and bench type pointers. In addition to photos of each type, brief descriptions of construction features, standard and special rolls, and motor or auxiliary drives are given. Included with the specifications for the three standard models of each type pointer is a table showing the range of standard finishing groove sizes for each model. Circular 795-W-2 is published by Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., or—
Circle Inform-A-Gram No. B3.

High Speed Steel Tool Bits are covered in a catalog. Typical analyses of five grades of high speed steel are included, with most of the catalog devoted to sizes, standard package quantities, weights per package, etc. Get your copy of Bulletin TBI-57 from Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, or —
Circle Inform-A-Gram No. B4.

Cold Heading Die Steel is the subject of a folder which gives heat treating data and specifications of the steel. Called Hedervan, the steel has advantages and applications which are also presented in the folder. Additional information may be obtained by writing to Latrobe Steel Co., Latrobe, Pa., for copies of the folder, or —
Circle Inform-A-Gram No. B5.

14" and 18" Type CH Universal Grinders are available from the Landis Tool Co. A 24-page catalog contains many pictures, sketches, and specifications. A section also discusses the design features of these machines. Get your copy of Catalog J-57 from Landis Tool Co., Waynesboro, Pa., or —
Circle Inform-A-Gram No. B6.

"Blind Bolts for High Strength Blind Fastener Applications" is a bulletin which discusses this line of products for structural and repair applications. Detailed diagrams of the structural applications are included along with material charts of specifications. This bulletin is supplied by Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif., or —
Circle Inform-A-Gram No. B7.

PREVIEWS

Circle postage-free Inform-A-Gram Key Number for your request

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

Flo-Pilot Valves are described in a catalog which includes a discussion of the Idea Starter control circuits. These valves are available in five basic models, and are ¼" pipe size for two or three-way air operation to

150 psi. They are used for remote control of master valves, directional control of small single acting cylinders, and for shut off. Hanna Engineering Works, 1765 Elston Ave., Chicago 22, is filling requests for Catalog 262, or —
Circle Inform-A-Gram No. B8.

Magnetic Friction Clutches and Brakes are outlined in a bulletin which illustrates and describes the items. Specifications of these Dyna-TorQ models are also included. Fast operation, self adjusting, and efficiency are among the advantages given in Bulletin MF-1 which is available from Eaton Mfg. Co., 3307 14th Ave., Kenosha, Wis., or —
Circle Inform-A-Gram No. B9.

A Stainless Fastener stock list and data book has been announced by Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. The 52-page book includes illustrations, thread and design specifications, and availability in a variety of corrosion-resistant metals of 40 basic fastening devices. Engineering data relating to the composition, properties, applications, and weights of stainless steels, are also presented. Copies can be obtained from the company, or —
Circle Inform-A-Gram No. B10.

15-Ton to 4000-Ton Capacity automatic presses are outlined in a 14-page brochure. They are of the inverted type with crankshaft located below the bed to produce lower center of gravity for minimum vibration at high speeds. These and other design features are discussed in the literature. The brochure is offered by Brandes Press Co., 6408 Euclid Ave., Cleveland 3, or —
Circle Inform-A-Gram No. B11.

Jig Borer Tools and accessories are featured in a bulletin which discusses precision jig boring. Specifications are given for the following tools: single point boring tools, end mill reamers, spotting tools, stub gages, end measures, and inside micrometers. Direct requests for copies of Bulletin 611 from Pratt & Whitney Co., Inc., Charter Oak Blvd., W. Hartford, Conn., or —
Circle Inform-A-Gram No. B12.

VARIMATIC®

The SUPER SENSITIVE, SMALL-HOLE, PRECISION DRILLING MACHINE

With capacity of .004" to 5/16" in *all* drillable materials, and spindle speeds from 840 to 9300 R.P.M. infinitely variable in two speed ranges . . . *this* is the machine which the precision industries rely upon to handle the "heart-break jobs."

"*for the finest work you do*"

ALSO . . .

Three companion drills, each built to the same accuracy but differing in drive, speed range, and clearances, to cover the full range of special precision requirements.

AND A TAPPER . . .

with capacity from .034" x 120 to ¼" x 24 . . . and a "reserve of accuracy."

2488

You will want full information about the Hamilton Line of precision drilling and tapping machines. And we will be glad to furnish it.

Ask for our
FREE
BULLETIN NO. 2488

ADDRESS

THE HAMILTON TOOL COMPANY
832 South Ninth Street
HAMILTON, OHIO

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE

CIRCLE INFORM-A-GRAM KEY NO. 143

FRICTION SAWING with Tannewitz

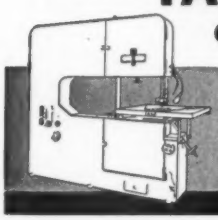
HIGH SPEED BAND SAWS

FASTEST, BEST MEANS OF CUTTING METALS

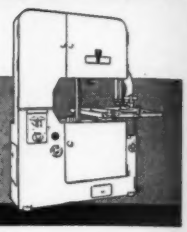
If you are not familiar with the advantages of friction sawing with these machines, by all means drop us a line asking for "Friction Sawing Data." You can save many times the cost of a Tannewitz High Speed Band Saw and greatly expedite production by using it to cut sheets of both hard and soft steel, formed or flat, trimming malleable and steel castings, cutting armor plate or many other materials. Write NOW!

THE TANNEWITZ WORKS

GRAND RAPIDS, MICHIGAN ☎ **GL-6-1729**

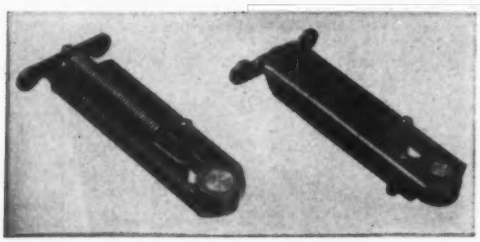


TANNEWITZ DI-SAWS — 24", 36", 48", 60" CAPACITIES
for CONTOUR SAWING, FILING, POLISHING
The smoothest, fastest, most trouble-free Di-Saws on the market.
Write for bulletin.



CIRCLE INFORM-A-GRAM KEY NO. 1441

FOR POSITIVE STOCK ALIGNMENT
IN PROGRESSIVE DIES



Amcor Roller Stock Pushers

SPEED UP PRODUCTION with precision-made AMCOR Roller Stock Pushers. Easy, smooth stock feeding, without buckling, assures more production with less operator fatigue.

SAVE MONEY. AMCOR Roller Stock Pushers sell for just a fraction of what hand-made bench models cost to make.

SIMPLE TO INSTALL. Requires only a slot milled in the stripper plate, and a hole drilled in the die block and stripper plate. Tracing template for slot and hole location is supplied. When die is sharpened, no refitting is necessary.

The AMCOR Roller Stock Pusher is quickly adaptable to any work specifications. Distributors throughout the country stock a complete line of nine models to fit all production needs.

Write us for complete information

APPLIED MECHANICS CORPORATION
528 Fourth Street N.W., Grand Rapids 4, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1442

write to **monroe**
Engineering Products Inc.
1515 Hurd Road, Monroe, Mich.

for fully illustrated catalog with accurate full size templates of assemblies

more than 1,000 details

CIRCLE INFORM-A-GRAM KEY NO. 1443

New **GRINDING MACHINE**
for Grinding Drills (0.012" to 0.120")

NOW, even the unskilled can sharpen drills perfectly every time. Compact. Furnished complete including Diamond Wheel dressing attachment.

EXCLUSIVE TERRITORIES OPEN

write for complete information and prices

Jersey manufacturing company
401-B LIVINGSTON ST. • ELIZABETH, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1444

Giant Power Groovers equipped for operating ease and speed, feature pushbutton controls located at the center of the machine. This and other features of the machine are outlined in a bulletin. Full details and specifications for this machine,

as well as for universal and hand operated groovers, are included along with step-by-step illustrations of single and Pittsburgh lock seaming. Copies of Bulletin 76D can be obtained by writing to Niagara Machine & Tool Works, 683 Northland Ave., Buffalo 11, or —
Circle Inform-A-Gram No. B13.

30 Basic Air Motor Units and torque limiting components for multi-spindle screw-drivers and nutrunners are illustrated in a bulletin. Fully dimensioned outline drawings will enable the tool engineer to develop preliminary plans for job-fitted production equipment. Bulletin 580-1 is supplied by Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, or—
Circle Inform-A-Gram No. B14.

Knuckle Joint Embossing Presses in capacities from 150 to 1000 tons for sizing, coining, embossing, and similar applications are described and illustrated in an 8-page bulletin. The Minster recirculating lubrication system is shown in a diagram. The Minster Machine Co., Minster, O., supplies copies of the Bulletin, Section 11, or —
Circle Inform-A-Gram No. B15.

Raditurn, the accurate short cut for turning any radius, convex, concave or ball, is featured in a bulletin. Pictures and descriptions show how the attachment works, and specifications are given for two models. Additional information may be obtained from Retco Mfg. & Sales, 1458 E. Clinton, Frankfort, Ind., or —
Circle Inform-A-Gram No. B16.

Sine Fixture Keys are the subject of a folder. A fast, low-cost method of fixture locating using these interchangeable keys is described and illustrated. Sine fixture keys eliminate layout and set-up time and are quickly interchangeable to fit any keyway, making standardized fixtures available to any free machine in the plant. For copies of this folder, contact Jergens Tool Specialty Co., 712 E. 163rd St., Cleveland 10, or —
Circle Inform-A-Gram No. B17.

High Frequency Motor-Generator induction heating equipment particularly applicable for efficient, low cost brazing, annealing, deep hardening, forging, etc. is covered in a bulletin. Included in the bulletin is a description of 960, 3000, and 10,000-cycle high-frequency motor-generator units available in sizes from 30 to 1250 kw. Obtain copies of Bulletin 12B8513 from Allis-Chalmers Mfg. Co., Milwaukee 1, or —
Circle Inform-A-Gram No. B18.

PORTELVATOR®
The Handy HAMILTON Portable, Elevating Table

A PORTABLE HEIGHT-ADJUSTABLE TABLE
• TRUCK
• WORK BENCH

for DIE TRANSFER
• MACHINE FEEDING
• ASSEMBLY AT BEST HEIGHT IN BEST LIGHT

LIFTING
• LOWERING
• TRANSPORT of SHEETS PLATES BARS TUBES PIPES TOOLS DIES FIXTURES
• ALL COMPACT HEAVY LOADS

UNOBSTRUCTED PERIMETER
•
WORK FROM ANY SIDE

MORE SERVICE for LESS MONEY than ANY Other Unit of Equipment

43 table surfaces
point support

LIFT LOWER TRANSPORT

FOUR-WHEEL and SIX-WHEEL MODELS

Recent changes and additions to the line provide greater capacities, new flexibility, many bonus features.

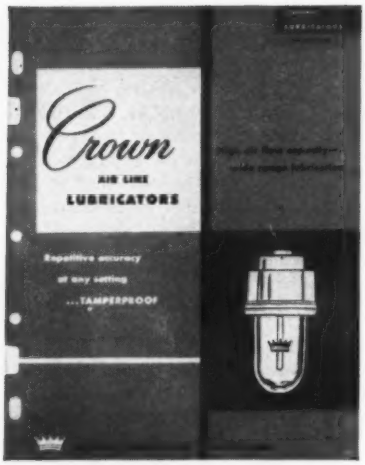
Write for NEW, FREE Bulletin P-5604

Address THE HAMILTON TOOL COMPANY,
832 South Ninth Street, Hamilton, Ohio

IT'S A Hamilton Tool
USE IT WITH CONFIDENCE
5604

CIRCLE INFORM-A-GRAM KEY NO. 145

Write for Bulletin 303



find out why...

Crown

lubricators are EASIER to fill!

Hannifin's new CROWN Line Lubricators have many advantages. They are precisely adjustable, and the adjustment is concealed, tamperproof. Oil feed is under positive pressure, so you get oil whenever air flows. But users like them best because they are the easiest of all lubricators to fill—you don't even have to shut off the air flow. Bulletin 303 tells why. Complete Crown stocks in most principal industrial areas.

HANNIFIN

Hannifin Company, 563 S. Wolf Rd., Des Plaines, Ill.
FILTERS • REGULATORS • LUBRICATORS

Hannifin Company
563 S. Wolf Road, Des Plaines, Ill.

Send me Crown Bulletin 303 and name of nearest distributor.

Name.....

Position.....

Firm.....

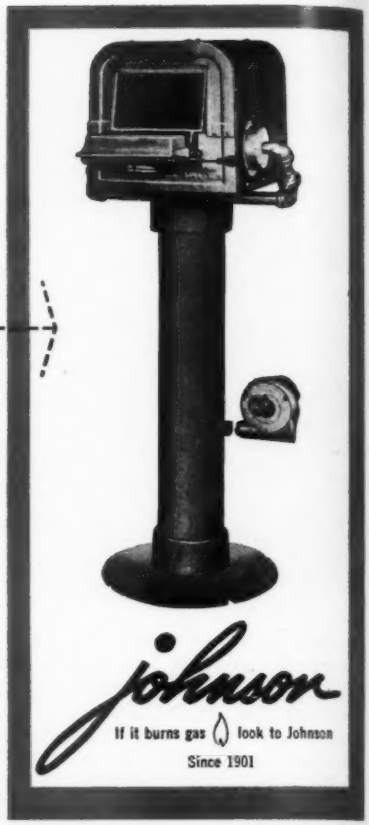
Address.....

City.....*State*.....

CIRCLE INFORM-A-GRAM KEY NO. 1461

1500° IN 5 MINUTES

2300° IN 30 MINUTES



johnson

NUMBER 120 HI-SPEED FURNACE

That's the kind of quick heating action you get with this compact, powerful furnace. It's economical to operate, too. Fast heat-up saves time and gas. High-temperature insulated firebox, 5" by 7¾" by 13½", gives even hardening of high speed and carbon steel dies, tools and small parts. Temperature easily regulated. G.E. motor and Johnson Blower included. 120,000 BTUs per hour.

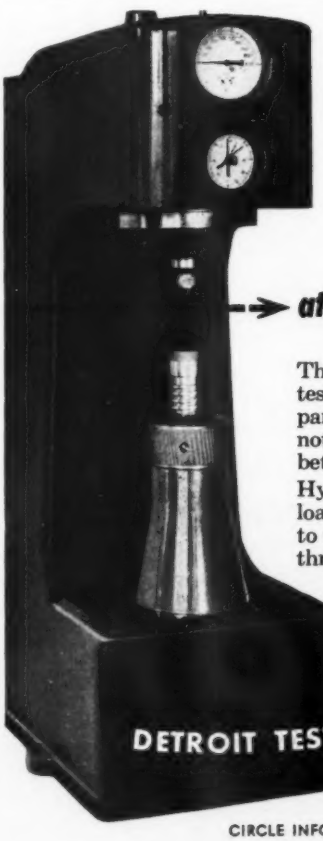
Pedestal style, F.O.B. Factory $184.00
No. 120 also available in bench style.

Write today for free Johnson Catalog

Johnson Gas Appliance Company
575 E Avenue NW, Cedar Rapids, Iowa

johnson
If it burns gas look to Johnson
Since 1901

CIRCLE INFORM-A-GRAM KEY NO. 1462



Brinell Testing

at production line speeds!

This direct reading Brinell hardness tester tests round or flat parts *fast*. No grinding of parts is necessary and the operator simply notes that the dial indicator needle falls between pre-set tolerance hands.

Hydraulically applied standard Brinell test loads are used. Foot control allows operator to test parts as quickly as he can move them through the machine.

Write for more information on all our Brinell testing machines.

DETROIT TESTING MACHINE COMPANY

9386 Grinnell Ave., Detroit 13, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1463

Turret Lathes, automatic thread grinders, precision boring machines, and optical comparators are some of the machines which are included in a bulletin. These products are described and illustrated, and explana-

tions of advantages and features are given. There is also a section on automation. Complete information may be obtained by writing to Jones & Lamson Machine Co., Springfield, Vt., for a copy of Catalog 57, or —
Circle Inform-A-Gram No. B19.

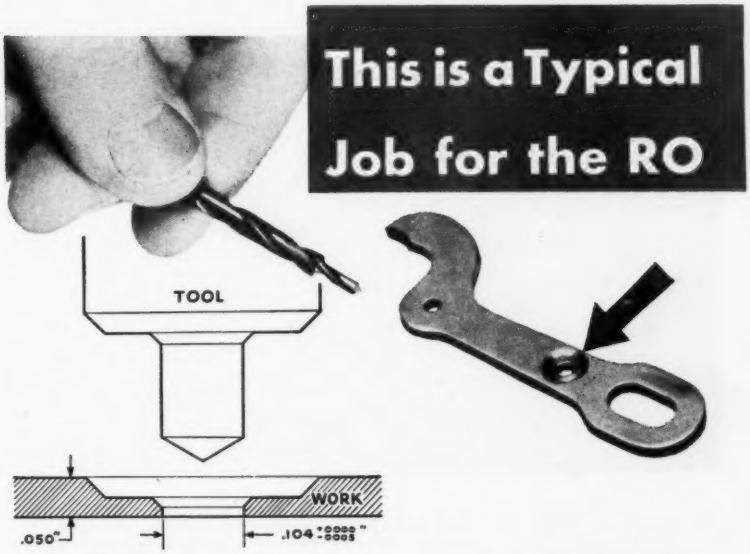
Expanding Locators are described and illustrated in a bulletin. Applications of these products are given along with specifications. They can be supplied for use in bores ranging from ⅜" up to 11" and are available in various means of actuation. For copies of Bulletin 24 contact Speedgrip Chuck, Div'n of Ernest, Holdeman & Collet, Inc., Elkhart, Ind., or
Circle Inform-A-Gram No. B20.

A Universal Rotary Table, available in three sizes, is offered in a bulletin. This product which can be used in two positions is fully described, and a list of specifications is included. A full line of accessories is also available. The bulletin is available from Universal Vise & Tool Co., Parma, Mich., or —
Circle Inform-A-Gram No. B21.

Sheet Steel and Plate Working Machinery is the subject of a brochure which explains the features of the metalworker. Pictures show the machine used in a variety of jobs. Complete specifications of all models are also given. For your copy of this brochure write to Tech-Pacific Corp., 2811 Lafayette St., Newport Beach, Calif., or —
Circle Inform-A-Gram No. B22.

Inserto U-Tap, a threaded fastener, is an internally and externally threaded steel insert that locks itself into the parent material at specified torque levels when driven. This and other advantages are described in a bulletin. Inserto is available in several sizes and the internal thread locking feature is optional. Copies of this bulletin are released by Rosan Inc., Dept. 290, Newport Beach, Calif., or —
Circle Inform-A-Gram No. B23.

Tools Using M-3 High Speed Steel for making holes in stainless and alloy steels on a production basis are described in a catalog. The catalog features a new heavy-duty hole-mill, a combination adjustable spot-facer and counterbore, the 3-blade hole makers and hole cutters, a circle cutter, and other tools. This catalog is prepared by Robert H. Clark Co., 9330 Santa Monica Blvd., Beverly Hills, Calif., or —
Circle Inform-A-Gram No. B24.



STANDARD DRILL CONVERTED TO SPECIAL IN LESS THAN 10 MINUTES

The user reports savings on this drill, which is used in quantity, to be $4.50 each when ground on his RO. The RO is the most useful and versatile cutting tool sharpener ever invented. It also has many applications other than tool sharpening: i.e., grinding a variety of forms on production parts: cams, squares, hexes, elipses, etc. Write for our catalog.

RO
UNIVERSAL
FORM RELIEVING
FIXTURE
R-O Grinder

GRINDER DIVISION
Royal Oak Tool and Machine Co.
29800 Stephenson Hy.
Royal Oak, Mich.

Please forward R-O catalog

Firm_____
Address_____
City, State_____
Per_____
Title_____

CIRCLE INFORM-A-GRAM KEY NO. 147

A Thread Rolling Attachment, for use on small automatics, is offered in a bulletin. The bulletin gives information on the use and application of this attachment and lists the specifications. Five standard sizes can be used on more than 100 different single and multiple screw machines and lathes. The bulletin is available from Reed Rolled Thread Die Co., Worcester 1, Mass., or —
Circle Inform-A-Gram No. B25.

Steel Conveyor Belting is the topic of a bulletin published by May-Fran Engineering, Inc., Clarkstone Rd., Cleveland 12. The belting installs flush with the floor, it will handle a wide range of materials or products, and it is available to meet individual specifications. Construction and applications of this product are also explained. Write to the company for your copy of the bulletin, or —
Circle Inform-A-Gram No. B26.

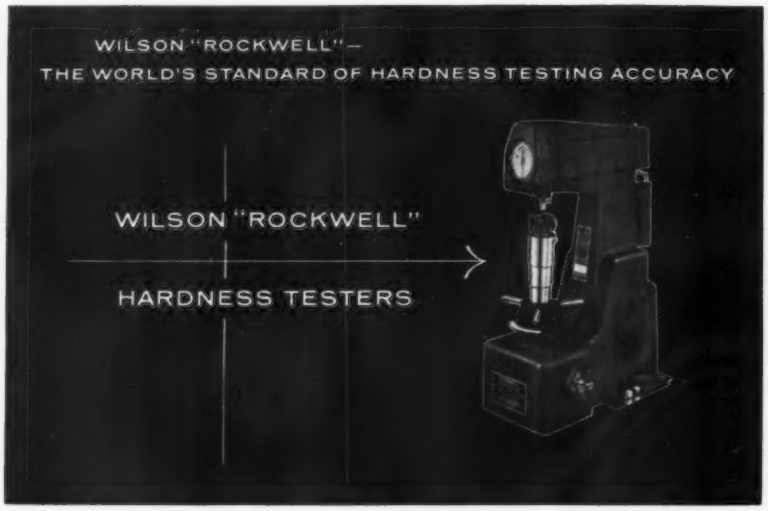
Open Die Rod Headers, used to upset heads on comparatively long rods which can not be handled on automatic rod headers, are the subject of a brochure. Data on production features, operation, blank handling,

punches and dies, heading units, and drives is included. Direct requests for copies of Brochure 866-A-3 to The Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., or —
Circle Inform-A-Gram No. B27.

1-HP and 2-HP Vertical Mills are illustrated and described in a 12-page catalog. This catalog covers in full detail the many cost cutting production features that are incorporated in the line of vertical mills. Write to Famco Machine Co., 3100 Sheridan Rd., Kenosha, Wis., for a copy of this catalog, or —
Circle Inform-A-Gram No. B28.

Cold Treating by low temperature techniques is the subject of a catalog. Pictures and drawings of various models of equipment are shown, along with a full page chart of examples and applications for such items as high speed drills, taps, milling cutters, etc. Copies of "Low Temperature Refrigeration" are supplied by Alpha Electric Refrigeration Co., 1115 E. Seven Mile Rd., Detroit 3, or —
Circle Inform-A-Gram No. B29.

An Angle Iron Shear, capable of cutting 2" x 2" x ¼" stock, is highlighted in a bulletin. In addition to the shear, the bulletin also describes two other tools, a bender and a notcher, and how the three tools can be combined on one stand requiring a total floor space of 21½" x 26". The bulletin is available from Whitney Metal Tool Co., 110-114 Forbes St., Rockford, Ill., or —
Circle Inform-A-Gram No. B30.



A FULL WILSON LINE TO MEET EVERY HARDNESS TESTING REQUIREMENT

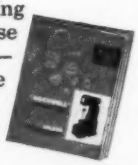
FULLY AUTOMATIC
•
SEMI-AUTOMATIC
•
REGULAR
•
SPECIAL
•
SUPERFICIAL
•
MICRO & MACRO HARDNESS TESTERS

For easy, accurate production tests

Sensitive and Accurate as a precision balance —the WILSON "Rockwell" hardness tester insures the quality of your products and protects your good name as a manufacturer.

Durable as a machine tool—WILSON "Rockwell" hardness testers withstand severe daily use with a minimum of service requirements.

A staff of WILSON hardness testing experts is available to help choose the model best suited to your job—and provide quick emergency service if it is ever needed.



Write for booklet DH-325 today

ACCO for Better Values

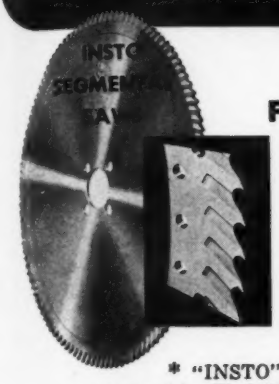
Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE

230-TP Park Avenue, New York 17, N. Y.

ACCO

CIRCLE INFORM-A-GRAM KEY NO. 148

CRAFTED IN SHEFFIELD* FOR MORE CUTS PER DOLLAR



BACKED BY MIDWEST'S FINEST SERVICE FACILITIES

- "INSTO" Segmental Saws Available from 11" through 72"
- Cost less because of greater production
- Suitable for ferrous and non-ferrous applicatiens
- Tungsten high-speed steel segments of unsurpassed quality
- Clean square cut with no material distortion
- Narrow Kerf allows maximum clearance for fast cutting
- Tooth design reduces friction for cooler cutting, longer saw life.

* "INSTO" segmental Saws are produced in Sheffield, England by Firth Brown Tools, Ltd., an internationally famous name in metalworking. They are serviced in Cleveland in Donley's modern saw shop. Send today for FREE BOOKLET on "Sharpening and Repairing Cold Saws".

ERNEST F. Donley's SONS, INC.
10203 Miles Ave., Cleveland 5, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1491

WALTER

PRECISION DIVIDING ROTARY TABLES

With and Without Dividing Discs

- READABILITY: 6 SECONDS.
- CONSTRUCTED FOR LONG LIFE.
- MAINTAIN PRECISION.
- AVAILABLE IN 10", 12½", 15¾", 19¾", 25", 31".

Also many types of Universal Precision Dividing Heads and Attachments for most economical production.

Test reports furnished with literature.

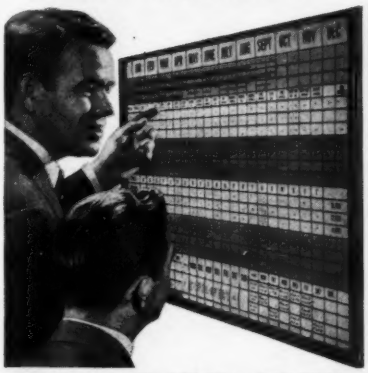
Sole Agents for U.S.A.

KARL A. NEISE
404 FOURTH AVE., DEPT. TP
NEW YORK 16, N. Y.

NEISE MODERN TOOLS

CIRCLE INFORM-A-GRAM KEY NO. 1492

How To Get Things Done Better And Faster



BOARDMASTER VISUAL CONTROL

- ☆ Gives Graphic Picture—Saves Time, Saves Money, Prevents Errors
- ☆ Simple to operate — Type or Write on Cards, Snap in Grooves
- ☆ Ideal for Production, Traffic, Inventory, Scheduling, Sales, Etc.
- ☆ Made of Metal Compact and Attractive. Over 200,000 in Use

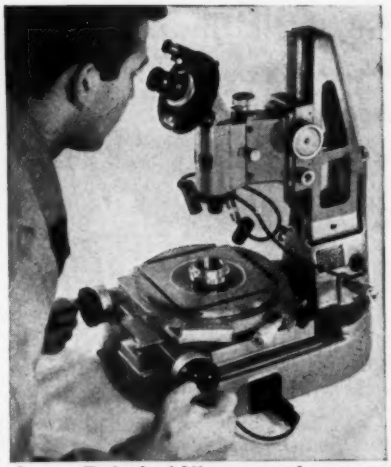
Complete price $49.50 including cards

FREE 24-PAGE BOOKLET NO. Z-100
Without Obligation

Write for Your Copy Today

GRAPHIC SYSTEMS
55 West 42nd Street • New York 36, N. Y

CIRCLE INFORM-A-GRAM KEY NO. 1493



Gaertner Toolmakers' Microscope used to measure typical piece part. Co-ordinate range 4" x 2".

Precise measurement to 0.0001" and 1 min. of arc

Gaertner Toolmakers' Microscope

Here is a reliable, easy-to-use microscope for precise measurement of piece parts, tools, dies, thread gages, templates, jigs, fixtures, etc. Ideally suited for making a wide variety of precision measurements and is especially valuable in reducing rejects in production work.

With the Gaertner Toolmakers' Microscope you make direct, non-destructive measurements — no contact, no distortion, images are sharp and clear. It is a basic measuring instrument for inspection depts., gage labs, tool and die and model shops, industrial and research labs.

The Gaertner Toolmakers' Microscope has been proven in use by U. S. Government Gage Laboratories, and by prime contractors and their subcontractors. With all parties using the same measuring instrument, inspection procedures are co-ordinated and disagreements and rejects minimized.

Features that help you get
HIGH SETTING AND REPEATING ACCURACY

- Low, compact built-in rotary stage reads to 1 minute of arc throughout 360° range.
- Minimum overhang of stages.
- Full 2" precision-lapped lead screws with correction device.
- Straightforward, direct, uncomplicated optical system.

Features that assure you of
EASY, CONVENIENT OPERATION

- Independently rotatable cross hairs in protractor ocular speed up measurements, simplify measuring procedure.
- Convenient location of ocular eyepieces for ease of reading.
- Built-in transformer and plugs for all illuminators.

Modifications and accessories to
MEET YOUR EXACT REQUIREMENTS

- Thread and radius templates, camera and spotting attachments, fine motion focus, variable magnification available.
- If you have a special measuring problem, our staff of representatives will be happy to consult with you. The service and engineering facilities of the manufacturer are always immediately available to help you.

Write for Bulletin 147-56

Designed and manufactured by

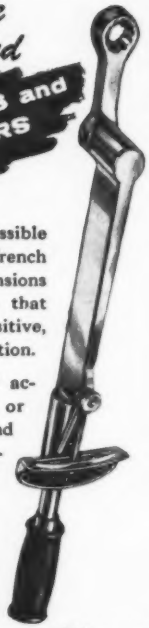
The Gaertner Scientific Corporation

1242 Wrightwood Ave., Chicago 14, Ill.
Telephone: BUckingham 1-5335

CIRCLE INFORM-A-GRAM KEY NO. 1494

Only **ONE** *Torque Wrench can be accurately used with . . .*

EXTENSIONS and ADAPTERS



It is mechanically impossible to use any Torque Wrench with adapters or extensions (with accuracy) unless that Torque Wrench has a positive, built-in, fixed load position.

This essential factor of accuracy, misunderstood or ignored in the design and manufacture of some torque tools, can completely defeat their purpose.

Patented pivoted handle fixes load position

Write for Torque Manual

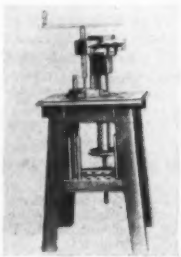
with formulae tables and explanations for correct use of adapters and extensions.

P.A. STURTEVANT CO. ADDISON QUALITY ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1501

NO BREAKAGE

PRODUCTO UNIVERSAL HAND TAPPER



For accurate hole-tapping without tap breakage, this Hand Tapping Machine is a "must" for every tool and die shop and toolroom. You can tap holes at any point in work within area of machine table. Quick-change spindles hold taps. Ready for instant use. Write for Bulletin TE4-102.

The Producto Machine Co.
970 Housatonic Avenue
Bridgeport 1, Connecticut

CIRCLE INFORM-A-GRAM KEY NO. 1502

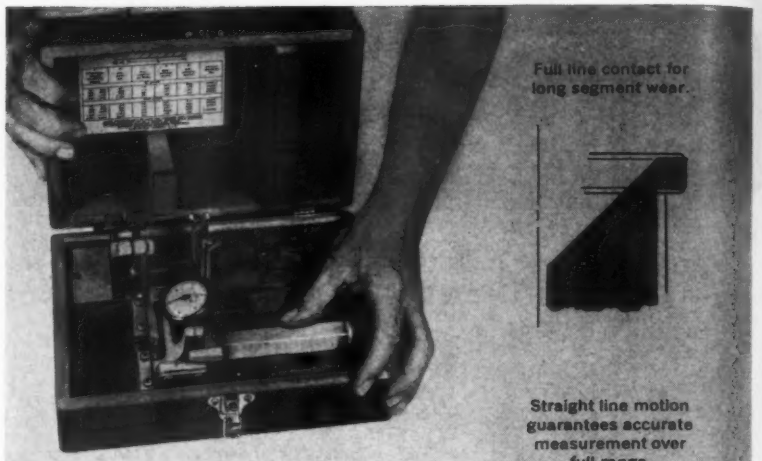
Low Cost Automatic
HORIZONTAL STOCK REEL
Self-powered

24" dia. $85.00
30" $90.00
36" $95.00

Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass

CIRCLE INFORM-A-GRAM KEY NO. 1503



Full line contact for long segment wear.

Straight line motion guarantees accurate measurement over full range.

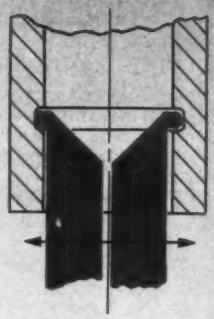
BRYANT GROOVE GAGE

This Kit Checks Grooves for

O-Rings — .421 to 4.870 Diameter.

Snap Rings — .267 to 5.266 Diameter.

- Line contact assures long segment life
- No bearings or sliding members to wear
- Selected Northern hardwood case
- Immediate shipment from stock



Special segments available for checking non-standard grooves, concentricity of groove to bore, or depth of groove to face.

Groove segments can also be used on the Bryant B-21 Bench Gage.

WRITE FOR FULL INFORMATION ON BRYANT GAGES

Bryant Gage & Spindle Division
P. O. Box 620-F, SPRINGFIELD, VERMONT
Division of Bryant Chucking Grinder Company

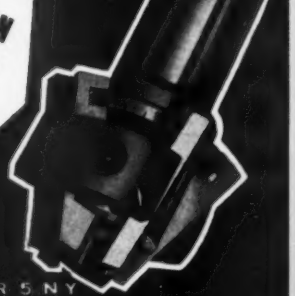
CIRCLE INFORM-A-GRAM KEY NO. 1504

KUTMORE
ADJUSTABLE HOLLOW MILLS

- Any COMBINATION of . . . Turning . . . Tapering . . . Facing . . . Chamfering . . . Trepanning in ONE PASS.
- Exclusive MICROMETER Adjustment Feature For Rapid Set-Up.
- Area Sales engineers for your immediate Problems.

WRITE FOR CATALOG 20 TP

PRECISION STARTS HERE



CARL WIRTH & SON, INC.
1625 CLINTON AVE. NO. ROCHESTER 5 N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1505

Weld Fasteners are the subject of a catalog which lists and describes each stock part, and is accompanied by all necessary dimensional data and illustrations of typical applications. A section gives ideas on how

to improve your own products and reduce production costs. Copies of this bulletin is supplied by The Ohio Nut & Bolt Co., 33 First Ave., Berea, O., or —
Circle Inform-A-Gram No. B31.

Taps, Dies, and Gages are featured in a catalog from Winter Brothers Co., Rochester, Mich. The 64-page catalog gives specifications and dimensions for each type of tap, die, and gage with illustrations. There is also a section of how to use pipe thread gages. For copies of Catalog 24 write to the company, or —
Circle Inform-A-Gram No. B32.

Huckbolt Fasteners and their application are explained in a bulletin which includes fastener nomenclature, shear and tension values, and hole size recommendations. A sequence drawing illustrates the driving cycle of the fastener. Complete dimensional information for the full line of Huckbolt fasteners is tabulated, covering both metal-to-metal and wood-to-metal applications. Catalog 8-414 can be obtained by writing to Huck Mfg. Co., 2480 Bellevue Ave., Detroit 7, or —
Circle Inform-A-Gram No. B33.

Standard Automation Units that can be retooled for different machining operations are highlighted in a bulletin, "Baker Basics, for Automation That's Easy to Retool." Pictures show what can be done to fulfill specific needs. Bulletin 117 is available from Baker Brothers, Inc., Toledo 10, O., or —
Circle Inform-A-Gram No. B34.

"Positive-Control Adhesive Bonding with Cycle-Bonding Machines" is the title of a bulletin which describes the process and the machines used in this operation. The line of machines are discussed and their advantages and particular jobs are outlined. Direct requests for copies of Bulletin CB-1 to Modern Industrial Engineering Co., 14230 Birwood Ave., Detroit 38, or —
Circle Inform-A-Gram No. B35.

A Chart tabulating the composition and physical properties of alloys commonly used for investment castings is now available from Alloy Precision Castings Co., 3855 W. 150th St., Cleveland 14. Two sets of mechanical properties are delineated, and investment castings design specifications are also included. Write to the company for your copy of the chart, or —
Circle Inform-A-Gram No. B36.

It's a fast service company, staffed with personnel who know that "DOWN-TIME" is "LOST-TIME". Distributors in principle cities assure IMMEDIATE DELIVERY from over 37,000 sizes in stock.

You get the finest quality in 3P HEAD PUNCHES and DIE BUTTONS, because they are made from 3 types of the finest tool steel, and are available in any DECIMAL size.

NEVER FEEL THE PINCH!
GET 3P PUNCHES AND DIE BUTTONS WHEN YOU NEED THEM.

Porter Precision Products also make BAL-LOK* Punches and Die Buttons. They're always in stock and ready for IMMEDIATE DELIVERY too. Any DECIMAL size.

NO EXTRA CHARGE FOR FAST SERVICE HIGH QUALITY, OR ODD SIZES.

PORTER PRECISION PRODUCTS
PRinceton 1-6338 • P.O.Box 208 • Cincinnati 15, Ohio

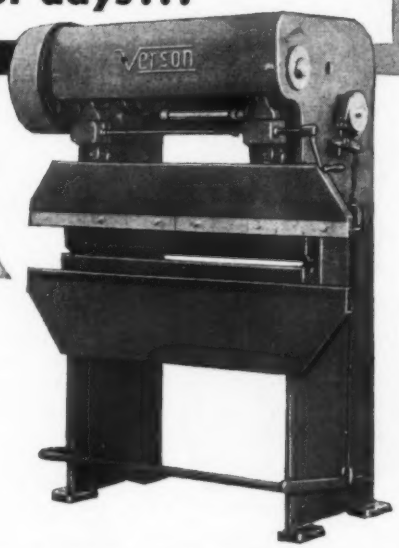
CIRCLE INFORM-A-GRAM KEY NO. 151

A Rotary Synchronizing Switch, a precise mechanical limiting switch, is illustrated and described in a bulletin. The switch controls the starting, stopping, interlocking, time-motion and sequence, and recycling of machine tools, as well as mechanical press auxiliary equipment. Other features and operations of the switch are also given. Write to E. W. Bliss Co., 1375 Raff Rd., S.W., Canton 10, O., for a copy of Bulletin 33-A, or — **Circle Inform-A-Gram No. B37.**

Geared Flexible Couplings are described in a book which deals with the complete line of couplings. The 12-page publication details pertinent application and selection data for couplings with maximum bores ranging up to 7" and ratings from 2½ to 572 hp/100 rpm. Specifications and detailed drawings of each type of coupling are also covered. For your copy of Book 2775 write to Link-Belt Co., Prudential Plaza, Chicago 1, or **Circle Inform-A-Gram No. B38.**

$1600*

will put this Power Press Brake to work in your shop in a matter of days...



IMMEDIATE DELIVERY FROM STOCK

STANDARD DIES

48" long, 90° "V" dies for handling 16 ga. stock in the 16-48 are priced at $102.

If you're trying to "get by" without a power press brake . . . or if you're tying up big brakes on small jobs . . . here's the answer to your problem — a rugged Verson Model 16-48 press brake. You can get one right "off the shelf" for only $1600*. You get the famous Verson all steel construction plus proved-in-service Verson design. Capacity is 16 ga. x 48" of mild steel. Write for complete specifications and then place your order. That's all there is to it . . . no involved proposals . . . no delays.

Prices F.O.B. Chicago, less dies; subject to change without notice. 160

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

-Verson-

VERSON ALLSTEEL PRESS CO.

9335 S. Kenwood Avenue, Chicago 19, Illinois

8300 S. Central Expressway, Dallas, Texas

CIRCLE INFORM-A-GRAM KEY NO. 152

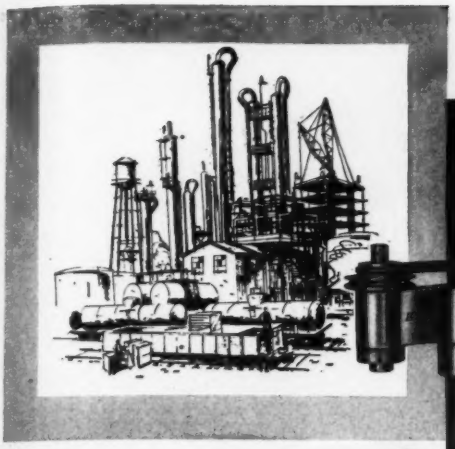
Measuring Devices are presented in a bulletin published by Size Control Co., 2500 W. Washington Blvd., Chicago 12. Among the many items listed are reversible plain and thread

plug gages, AGD thread ring gages and setting plugs, adjustable limit snap gages, ring gages and master setting discs, etc. For a copy of Catalog 57 write to the company, or **Circle Inform-A-Gram No. B39.**

Cylindrical Grinding Wheels are described and illustrated in a 4-page bulletin. A specification table lists thickness and bore of each of the Dayton Safety grinding wheels in stock, and it gives standard diameters which range from 12" to 36". A portion of the bulletin is devoted to practical grinding hints and tips. Copies of "Cylindrical Grinding Wheels" are published by The Simonds Worden White Co., 1101 Negley Pl., Dayton 7, O., or — **Circle Inform-A-Gram No. B40.**

"Short Cuts to Greater Profits" is the title of a booklet which shows how steel shelving can be used to save steps and searching, to simplify stock control, and to prevent damage to parts. Suggestions for ways of using the shelving are given along with specifications and services offered by the company. For your copy write to Equipto, Aurora, Ill., or—**Circle Inform-A-Gram No. B41.**

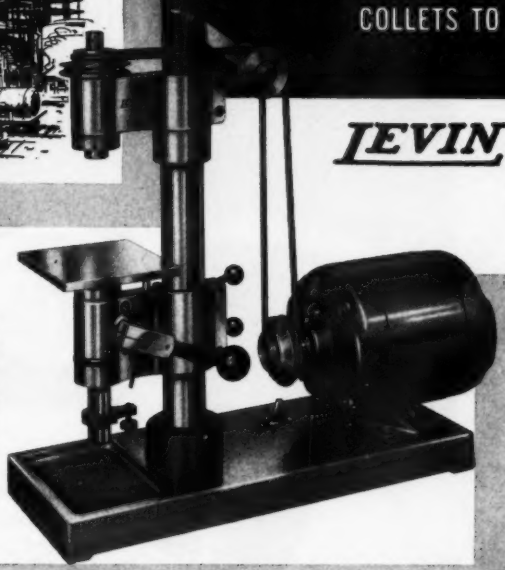
Either Wire or Flat Stock can be handled by a cut-off machine discussed in a brochure. It has a capacity of up to 3" in width and up to 30' in length for each cut. This and other advantages and specifications are included in the brochure. Copies of the brochure are supplied by Durant Tool Supply Co., 1-15 Thurbers Ave., Providence 5, or — **Circle Inform-A-Gram No. B42.**



EQUIP FOR THE SIZE OF THE JOB

SMALL DRILLS MUST BE HELD IN PRECISION COLLETS TO ASSURE ACCURACY

LEVIN® MICRO DRILL PRESS FOR VERY SMALL HOLES DOWN TO .002"



SPECIFICATIONS:
Size of table is 3-3/4" x 4". Maximum table travel is 1-1/2". Greatest distance between table and end of spindle 4". Preloaded ball bearing spindle with four speeds 1725, 2600, 3000, 4700 RPM. Motor 1/2 HP, 110V, 60C. The micro-drill press may also be had with a 3450 RPM motor; doubling the above speeds.

In the LEVIN micro-drill press drills are held in precision collets. Runout is reduced to practically zero and drill breakage from this cause is eliminated. Collets are available in a complete range of sizes down to .1 mm (.004"). **Send for catalog M describing complete line of micro-drilling equipment, collets, instrument lathes and precision tools. Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.**

CIRCLE INFORM-A-GRAM KEY NO. 1531

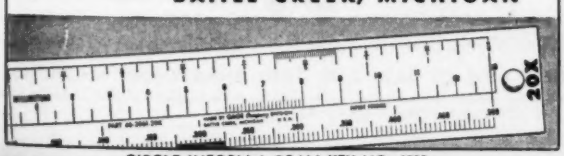
Gage Company PRECISION PLASTIC
COMPARATOR SCALES

Non-breakable...accurate...designed for making quick measurements at scale on projectors and comparators without any movement of machine or work.

An unexcelled tool for use in drafting and constructing scale layouts for comparator chart use. All standard magnifications and various styles for every application.

WRITE FOR BULLETIN NO. 54-1511

GAGE COMPANY
BATTLE CREEK, MICHIGAN



CIRCLE INFORM-A-GRAM KEY NO. 1532

HAVE YOU CHECKED YOUR *COUNTERSINKING COSTS* LATELY?

A *Severance* CARBIDE ECONO-SINK WILL GIVE YOU —

- INCREASED ACCURACY
- MORE PRODUCTION
- SMOOTHER SEATS
- LONGER CONSISTENCY OF OPERATION
- LESS DOWN-TIME
- AND A COMPLIMENT FROM THE BOSS FOR SUGGESTING THE CHANGE

Chatter-Free DESIGN
Solid CARBIDE CUTTING HEADS
Make the Switch to Carbide BEFORE IT'S TOO LATE

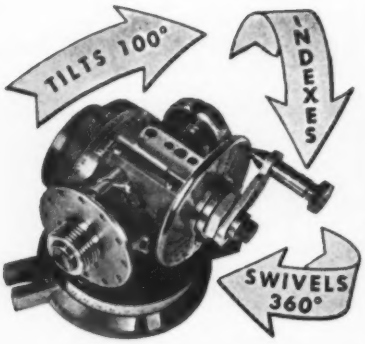
WITH THE NEW Severance CARBIDE ECONO-SINK YOU GAIN ALL THE ADVANTAGES OF CARBIDE TOOLING - AND AT LESS COST per Countersunk Hole

Ask for Information & Prices TODAY!

Severance TOOL INDUSTRIES INC.
730 Iowa Avenue — Saginaw, Michigan

New 1958 Catalog ready for distribution, ask for a copy today!

CIRCLE INFORM-A-GRAM KEY NO. 1533



FOR FASTER PRODUCTION

THE **ELLIS**

DIVIDING HEAD

Although it is built to fine instrument standards, the ELLIS is a really *rugged* tool room or production tool that's designed for unusual versatility. Its universal motions — swiveling in two planes — will save time and increase profits and accuracy on your millers, grinders, drill presses and jig borers. It has 6½" swing, or 11" swing when used with riser blocks. Work may be held between centers, or in chucks or collets. To save rehandling of work, and to save money, investigate the ELLIS by writing for complete details!

NICHOLS MORRIS CORPORATION
76-X MAMARONECK AVE.
WHITE PLAINS, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1541

economically priced press room equipment

DURANT "SURE-DRIVE" COIL CRADLE

Easy to load trouble free performance provides constant slack loop for feeding presses, forming rolls, shears, slitters, etc. Available in 11 models wide variety of capacity O.D. maximum ranges 36" to 48" and width maximum ranges 10" to 20".

WRITE FOR NEW FREE CATALOG

DURANT TOOL SUPPLY CO.
PROVIDENCE 3, RHODE ISLAND

CIRCLE INFORM-A-GRAM KEY NO. 1542

When storm clouds gather ... turn fast to ABC ACCURATE BUSHING CO.

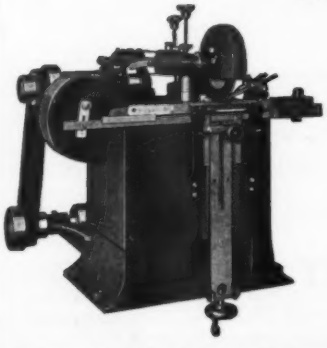
Bushings a bottleneck? Cut production delays. Reduce bushing wear as much as 20% with precision finished Accurate Drill Jig Bushings. ABC Bushings hold dimensional accuracy longer because they're made of chrome bearing steel. **You get them faster, too** .... "same day" shipment on all cataloged standard sizes. Custom orders receive special custom service. Eight conveniently located warehouses to serve *you* better. Write today!

ACCURATE BUSHING COMPANY
ASA STANDARD DRILL BUSHINGS • PRECISION PARTS
PIERCING PUNCHES

ABC **444 North Avenue, Garwood, N. J.**

CIRCLE INFORM-A-GRAM KEY NO. 1543

RESHARPEN YOUR SAWS
Over and Over Again



Wardwell "EC" Combination Grinder will sharpen a gross of Hack Saw Blades at least 6 times, thus saving the price of the machine.

Only grinder that does not depend on shape of grinding wheel to form shape of teeth.

Write for Bulletin EC

Sharpens Hack, Band or Circular Saws

WARDWELL
3809 Ridge Road
Cleveland 9, Ohio

MAKER OF LARGEST LINE OF SAW AND TOOL SHARPENING MACHINES

CIRCLE INFORM-A-GRAM KEY NO. 1544

A Marking Department on Wheels has been built by George T. Schmidt, Inc., 4112 Ravenswood Ave., Chicago 13, and is described in a bulletin. This unit contains every item necessary for hand stamping and provides the tools and working area needed. A list of other features of the marking cruiser and specifications are included in the bulletin. Write to the company for your copy of the "Marking Cruiser" bulletin, or —
Circle Inform-A-Gram No. B43.

A Floor Type Chip Separator is the subject of a bulletin which describes the machine as well as its operations. The Model M will separate screw machine production from chips, parts of steel, brass, or aluminum, and will separate a maximum of 500 parts from chips in one minute. Other advantages are outlined in the bulletin. Request copies from The McKenzie Engineering Co., S. Main St., Newton, Conn., or —
Circle Inform-A-Gram No. B44.

Ways, Wear Plates, aluminum bronze slides, and standard cross sections are presented in a bulletin published by The Ohio Knife Co., Dept. LL-65, Cincinnati 23. In addition to specifications of these products, there is also a section which gives the cross sections of standard ways in diagram form. For more information, request copies of the bulletin from the company, or —
Circle Inform-A-Gram No. B45.

A Swivel Copymatic Lathe is featured in a brochure which details the description and operations of this machine. This lathe does square shoulder step turning with the swivel slide set at 90° and contour facing in front of the center with the swivel slide set at 0° with equal speed and accuracy. For more information about this lathe write to Lodge & Shipley Co., Cincinnati 25, for copies of Bulletin 84, or —
Circle Inform-A-Gram No. B46.

Drill Without Jigs with the Burgmaster two-axis positioning table which is described in a bulletin. This product is used for prototype and short run production of parts requiring precision hole location, and the operation sequence, tape preparation, and other information is included in the bulletin. For copies of "The Tape Controlled Burgmaster" write to Burg Tool Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif., or —
Circle Inform-A-Gram No. B47.

Acroflex, a formative steel strapping for use in maintenance departments, is described in a bulletin. Applications of the strapping are illustrated and explained. The flexibility of the product makes it applicable to a number of jobs. For more information about Acroflex write to Acro Metal Stamping Co., 332 E. Reservoir Ave., Milwaukee 12, for your copy of the bulletin, or —
Circle Inform-A-Gram No. B48.

"8 Reasons" is a bulletin which gives helpful, detailed information on standard bar and tube stock. The bulletin points out that the tubes and bars are suited for production of bearings, bushings, gears, liners, pump and valve parts, etc. Copies of Bulletin 156 are available from the Centrifugally Cast Products Div'n, The Shenango Furnace Co., Dover, O., or —
Circle Inform-A-Gram No. B49.

WICKMAN-BROWN *Fully Floating*
MICROMETER ADJUSTABLE REAMERS

Typical Applications:
- LATHES • TURRET LATHES
- MULTI SPINDLE AUTOMATICS
- CHUCKING MACHINES
- SINGLE SPINDLE AUTOMATICS
- VERTICAL AND HORIZONTAL BORING MILLS
- JIG BORERS
- GENERAL TOOL & DIE ROOM AND SHOP MAINTENANCE

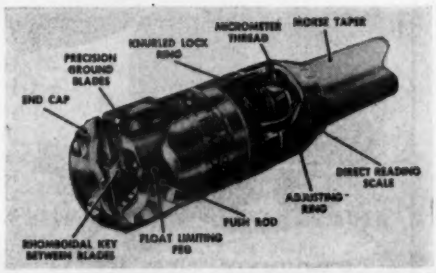
Type S for through hole reaming.
Type SL for blind hole reaming.
Range in Sizes: ¾" to 8" in only 18 units

Type SO for through hole reaming only—range from ½" to ¾" in ONLY 5 Sizes.

• The initial cost of a Wickman-Brown reamer is your last major expenditure. The blades, available in both high speed steel and tungsten carbide, are precision ground and may be sharpened repeatedly without affecting micrometer reading.

Eliminates costly floating tool holders by built-in positive and predetermined float.

Down time is eliminated on production due to micrometer adjustability without removal of blades or unit from machine.



Distributors' Inquiries Invited

THE Wickman MANUFACTURING CO.
10329 CAPITAL AVENUE (OAK PARK) DETROIT 37, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 155

Spray Nozzles are the subject of a comprehensive catalog published by Spraying Systems Co., 3201 Randolph St., Bellwood, Ill. This catalog includes many nozzles for many different operations and gives specifications and capacity range. There is also a chart which lists the applications of nozzles and gives the correct type for that job. Request copies of Catalog 24 from the company, or —
Circle Inform-A-Gram No. B50.

A Torque Wrench Calibrator, its performance characteristics, and model specifications are outlined in a bulletin. The bulletin covers model dimensions, weights and torque ranges for six models of the calibrator, including torques from 0 to 200 in-oz to 0 to 2000 ft-lbs. Request your copy of Bulletin 210 from Skidmore-Welhelm Mfg. Co., 442 Green Rd., Cleveland 21, or —
Circle Inform-A-Gram No. B51.

REDUCE
Precision Hole Grinding Costs
USING AN
Onsrud
D1-S
HOLE GRINDER
MOUNTED ON YOUR
LATHE
MILLING MACHINE
RADIAL DRILL
¼ HP 50,000 RPM AIR TURBINE GRINDER
SLIDE ADJUSTS TO 0.0001"
Grind precision holes at amazingly low costs with the D1-S . . . using your present machine tools. A completely RIGID unit guaranteed not to deflect in its vertical alignment. Grease-shielded, long life bearings. Capacity up to 2¾" diameter with ¾" wheel . . . and up to 4" diameter with adapter. Proper high speed and power for dependable, fast operation with toughest steels.
OR MOUNT ON JIG BORER TO CONVERT MACHINE TO PRECISION JIG GRINDER
ONSRUD MACHINE WORKS, INC.
PORTABLE TOOL DIVISION
3941 PALMER ST., CHICAGO 47, ILL.
WRITE FOR FREE D1-S HOLE GRINDER BULLETIN 1126
CIRCLE INFORM-A-GRAM KEY NO. 156

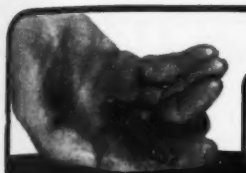
Electric Ovens, furnaces, Magni-Whirl water and oil baths are presented in a 48-page catalog. It also covers environmental cabinets and controlled temperature equipment for production. Photographs and condensed specifications are included for Blue M standard equipment, giving size, temperature ranges, voltages, and capacities. Catalog M-57 is available on request from Blue M Electric Co., 138th & Chatham Sts., Blue Island, Ill., or —
Circle Inform-A-Gram No. B52.

Magnesium and Aluminum Alloys are the subject of a catalog which lists physical properties and conforming specifications. Listings include alloys for sand castings, permanent mold, and rare earth alloys. There is also a section on how these alloys are produced and the properties from which the alloys are made. Write to The Wellman Bronze & Aluminum Co., 12800 Shaker Blvd., Cleveland 20, for a copy of "Wellman Prototype to Finished Castings," or—**Circle Inform-A-Gram No. B53.**

The Accu-Cast Method of precision-casting mold and die components in steel and other castable metals, direct from expandable original patterns, with no need for costly and time-consuming machining of steel master hobs, is explained in a bulletin. A panel of production pictures shows typical applications of this method. Copies of the folder are available from Manco Products, Inc., 2401 Schaefer Rd., Melvindale, Mich., or —
Circle Inform-A-Gram No. B54.

A Marking Machine for an automated line is the subject of a bulletin which illustrates and describes the machine. Operating features and specifications are presented, and a diagram accompanies a discussion of the toggle linkage design. Bulletin SM57 is made available by New Method Steel Stamps, Inc., 147 Joseph Campau, Detroit 7, or —
Circle Inform-A-Gram No. B55.

Borolon Tumbling Abrasive for barrel finishing is described in a bulletin. This material is aluminum oxide abrasive in chips and screened grain sizes for a wide range of use. New sizing standards for chips also are discussed. Form ESA-236 is made available from Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, or —
Circle Inform-A-Gram No. B56.



You Need an Extra Hand Now to Speed Up Production!

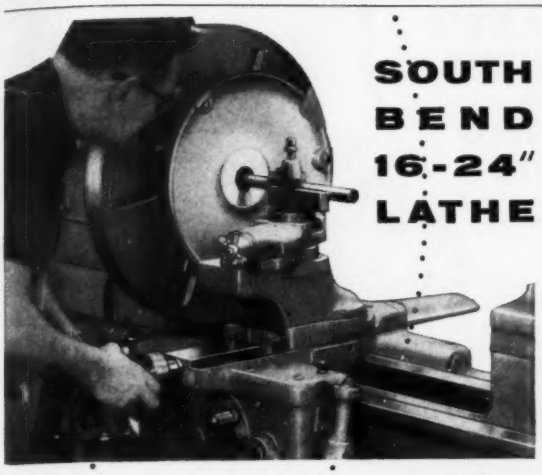
IN 11 SIZES No. 6 to 1" N.C. In all S. A. E. sizes.

HEIMANN TRANSFER SCREW SETS

Here is the *faster*, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench —no other tools needed. Get more work *now*—save money too!

HEIMANN MFG., CO. • URBANA, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1571



SOUTH BEND 16-24" LATHE

25" Swing - Ideal for Outsize Work

- Up to 126" between centers.
- Takes large diameter work of medium weight.
- Eliminates expensive heavy-duty lathes.
- Accurate . . . versatile . . . easy to handle.
- Efficient on small routine work.
- Prices start at only $2662.
- *Write for catalog.*

Up to 24 months to pay.

SOUTH BEND LATHE

SOUTH BEND 22, INDIANA

Builders of Lathes, Milling Machines, Shapers, Drill Presses and Pedestal Grinders.

CIRCLE INFORM-A-GRAM KEY NO. 1572

Fluid-Feed

ROTARY TABLE

Feeds parts fast! Combines with other stock units for easy, cost-cutting automation.

Write for complete catalog today!

THE MEAD MAN CAN HELP YOU CUT COSTS Now!

MEAD SPECIALTIES COMPANY

4114 N. Knox Ave., Dept. HA-127, Chicago 41, Ill.

PATHFINDER IN AIR POWER AUTOMATION

CIRCLE INFORM-A-GRAM KEY NO. 1573

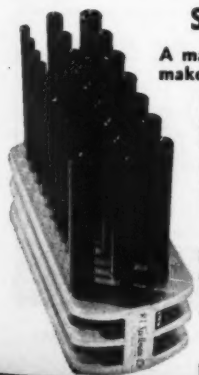
NEWS!

LARGE CAPACITY GRINDING PROBLEMS SOLVED AT MICRO PLANE!

Write for descriptive literature

MICRO PLANE, Inc. 7017 St. Clair Ave. Cleveland 3, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1574



SPELLMACO SPOTTERS

A matched set of transfer punches for toolmakers, machinists and tool cribs.

Used for transferring location of threaded, drilled and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel carefully heat treated and tempered for long life. .0025 undersize to facilitate use—black oxide finish.

Set No. 3-17: 28 punches with indexed stand—sizes 3/32" to ½" by 1/64" plus hand 17/32" size—length 4⅞". PRICE only $17.90

Single size available.

R. L. SPELLMAN CO. • Urbana, Ohio

NOW GET CLEAN SURFACED PARTS FROM YOUR AUTOMATICS . . . *UNMARRED* BY TOOL WITHDRAWAL MARKS

THE NEW **RELIEVOMATIC SELF-RELIEVING TOOL HOLDER**

SAVES YOU COSTLY SECONDARY FINISHING OPERATIONS

Avoid scratches like this

All clear with "Relievomatic!"

Easily installed on cross-slide or turret

Write today for details.

SILBER PRODUCTS, INC. Nightingale 9-8600

870 Essex Street • Brooklyn 8, N. Y.

FIRMLY BUT GENTLY

WITH WOODWORTH CHUCKING EQUIPMENT

Our tough looking character who is holding the little bird clearly demonstrates one fact: whenever you are holding *anything* it should be secured with gentle firmness. And this is so true when considering chucking equipment.

Your best machine will produce only as accurately as its work-holding device permits and Woodworth manufactures the most rugged, accurate and dependable chucks for precision machining in America.

We invite your inspection and consideration of N. A. Woodworth products. There is a Woodworth Sales Representative in your area and a letter to the N. A. Woodworth Company will place him promptly at your service.

"Accuracy you can trust"

WOODWORTH
1300 East Nine Mile Road
Detroit 20, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1581

FOR THE "HOLE" FIELD

NEW CONCEPT IN AUTOMATIC DRILLING AND TAPPING UNITS

MODEL 500
DULL TOOL LITE
AND
SUB-BASE

AUTOMATION | **DRILLMATION** | **TAPMATION**

Drillmation's hydraulic, locked-circuit feed Drilling and Tapping Units are the finest and most completely self-contained of any similar unit available today. Drillmation also offers more essential and exclusive features. Write TODAY for literature.

12 ESSENTIAL Exclusive FEATURES in 1 Unit

- **DULL TOOL CONTROL** Unit will withdraw tool from work and indicate to operator when tool becomes dull.
- **RAPID TOOL CHANGE** Tool may be replaced without changing the controls.
- **UNIFORM TIME CYCLE** Maintains comparatively constant time cycle even when tools become dull.
- **SELF-CONTAINED HYDRAULIC SYSTEM** Delivers only the oil pressure required to overcome machining resistance.
- **COMPLETELY AUTOMATIC** Enclosed electric controls. Unit is "Fail Safe".
- **THRUST CONTROL** Maximum thrust may be set to protect tools. Will not surge at break point.
- **FEED CONTROL** Infinitely variable and positive feed rate.
- **RAPID APPROACH AND RETURN** Variable irrespective of RPM.
- **MICRO DEPTH CONTROL** Depth will repeat within .0005 inch.
- **EMERGENCY QUILL RETURN** Button on front of unit. Aid in setting tools.
- **COOL OPERATION** Low volume high pressure hydraulic pump used on power stroke only. Air power used for rapid traverse.
- **PRODUCTION MACHINE** Mount in any position. Quiet operation. Self lubricating.

DRILLMATION

DRILLMATION CO.
6500 E. ELEVEN MILE ROAD
CENTER LINE, MICHIGAN
JEfferson 9-2030

CHICAGO OFFICE DRILLMATION SALES and SERVICE
5653 W. NORTH AVE. • MErrimac 7-3305

CIRCLE INFORM-A-GRAM KEY NO. 1582

HARDNESS TESTING
has been done with the **SCLEROSCOPE**
Since 1907

•

THE SHORE INSTRUMENT & MFG. CO., Inc.
90-35 Van Wyck Expressway
Jamaica 35, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1583

CAMS ALL TYPES MADE TO YOUR SPECS

Mfrs' agents wanted

Dr. Chas. Eisler ME, Founder
Chas. Eisler, Jr., Pres.

EISLER ENGINEERING CO., INC.
732 SO. 13TH ST. NEWARK 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1584

Miniature Precision Ball Bearings are outlined in a 24-page catalog. The catalog describes in detail the standard radial miniature bearings which range in size from 1/10" to 3/8" OD. There is descriptive matter and

bore dimension charts on all the radial types including radial retainer, flanged radial retainer, single and double shield radial retainer, etc. Miniature Precision Bearings, Inc., Keene, N. H., is handling the catalog, or—**Circle Inform-A-Gram No. B57.**

Cutting-Off Machines, automatic loaders, and hot spinning machines are featured in a folder. Outstanding features, capacities, and special machines are listed. There is also a chart of production. More information may be obtained by writing Modern Machine Tool Co., 2005 Losey St., Jackson, Mich., for copies of the bulletin, or —
Circle Inform-A-Gram No. B58.

An Automatic Set Screw Feeder and Driver is presented in a bulletin which shows both the pedestal type and bench type models. Features of this machine along with specifications are outlined. This machine will handle a range of screw diameters from No. 2 through 5/8". Bulletin 758 is published by The Bristol Co., Waterbury 20, Conn., or —
Circle Inform-A-Gram No. B59.

Reamers, Twist Drills, end mills, and other carbide tools are listed in a catalog issued by Super Tool Co., 21650 Hoover Rd., Detroit 13. Included in the specification chart is a listing of diameter and overall length, and illustrations accompany each section. The 36-page catalog may be obtained from the company, or—**Circle Inform-A-Gram No. B60.**

"Micro-Velvet" Balls, including lapped high carbon chrome balls accurate within millionths of an inch, are presented in a bulletin. Detailed specifications as well as helpful application and design data are provided for balls of chrome steel, stainless steel, brass, bronze, and monel in various grades and in sizes ranging from 1/16" to 4 1/2" in dia. Copies of Bulletin 101 are available from Hoover Ball and Bearing Co., Ann Arbor, Mich., or —
Circle Inform-A-Gram No. B61.

A Range of precision industrial fasteners, for a wide variety of production assembly and maintenance applications, is reviewed in a revised bulletin. It covers the complete line of standard industrial fasteners including Unbrako socket screw products, Flexloc self-locking nuts, etc The illustrated literature gives range of sizes, materials, finish, and other specifications. The bulletin is available from Standard Pressed Steel Co., Box 600, Jenkintown, Pa., or—
Circle Inform-A-Gram No. B62.

TWO MODELS AVAILABLE: Style 142 for conventional grinding with vitrified or diamond wheels; Style 264, equipped with metal-bonded diamond wheels, for electrolytic grinding.

new

DUAL PURPOSE RECIPROCATING TOOL GRINDER

Ex-Cell-O takes all the work out of both conventional and chip-breaker tool grinding

Now an entirely new reciprocating double end tool grinder designed by Ex-Cell-O to do two jobs in one—conventional grinding on one end, chip-breaker grinding on the other—has now been added to Ex-Cell-O's line of conventional, double end, carbide and Method X tool grinders. The difference is the adjustable, power-controlled reciprocation of grinding wheels. The operator need only hold the tool at the pre-set angle.

See for yourself the capabilities of this new Ex-Cell-O—contact your local Ex-Cell-O Representative. Or, write direct for Bulletin 461872.

EX-CELL-O CORPORATION Machinery Division
DETROIT 32, MICHIGAN

57-96

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

CIRCLE INFORM-AIGRAM KEY NO. 159

Here's to

Happy Holidays

With the happy holiday season upon us we rise to the occasion for a toast to our good customers and friends who have so loyally contributed their part to make the year pleasant and profitable. So here's to you with our best wishes for a

Merry Christmas
and
Happy New Year

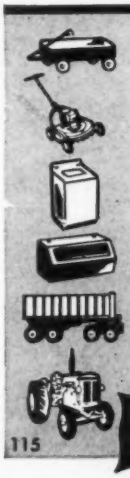
THE WELDON TOOL COMPANY
3000 Woodhill Road · Cleveland 4, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1601

SPECIFY GRIPCO LOCK NUTS

to resist stress, wear and vibration

They increase product durability at low initial cost



Simple one piece design — no inserts — no outside devices. Nothing complicated — the Gripco locking action is within the nut itself, yet you get low initial cost and low application cost with increased customer satisfaction. Speed production and lower manufacturing costs on your products now.

Send for samples and full particulars.

Gripco Products Include:

Gripco Lock Nuts • New Gripco "Clinch Nuts" Gripco Hi-Nuts • Gripco Pilot-Projection and Countersunk Weld Nuts

all with or without the famous Gripco positive locking feature. Also Standard Semi-Finish Nuts.

115

GRIP NUT COMPANY
Maple Ave. • South Whitley, Ind.

CIRCLE INFORM-A-GRAM KEY NO. 1602

FONDA

GAGE BLOCKS

STEEL AND TUNGSTEN CARBIDE
SQUARE AND RECTANGULAR
ACCESSORIES

Prompt, Economical Inspection Service

Please Send for Catalog

FONDA GAGE COMPANY, INC.
200 HENRY STREET, STAMFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1603

PRESSURELOK-224

the best diamond wheel ever developed for carbide tool grinding. Guaranteed ultimate cutting life from each diamond particle in every wheel.

US

UNITED STATES DIAMOND WHEEL CO.
1833 ILLINOIS AVE. AURORA, ILL.

IMMEDIATE DELIVERY on all wheel sizes. STRAIGHT, DISH, CUP, FLARE and MOUNTED WHEELS; HONES.

CIRCLE INFORM-A-GRAM KEY NO. 1604

Mold your own LEAD HAMMERS

Here's the inexpensive, fast way of molding and remolding your own lead hammers with this COOK mold and ladle. It produces hammers that can "take it" Simple to operate.

Write for circular and prices

LAWRENCE H. COOK, INC.
60 NARRAGANSETT AVENUE, EAST PROVIDENCE 14, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 1605

IT'S PLAIN TO see

A Boring Head That Won't Face is NOT Complete

NOW you can get a boring head that will BORE, FACE, TURN and GROOVE at no more cost than you would pay for a plain, single purpose boring head.

LOOK INTO THIS before you buy that new head. Write for full details.

CHANDLER TOOL CO.
Muncie, Indiana, U.S.A.

Chandler-Duplex
COMBINED BORING AND FACING TOOLHEADS

CIRCLE INFORM-A-GRAM KEY NO. 1611

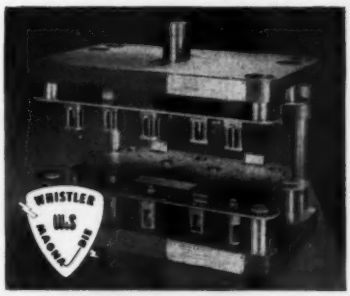
"HILLCO" TANGENT CHASERS

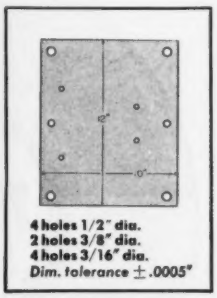
The new line of "HILLCO" Tangent Chasers, which can be re-ground for 80% of their original length, are guaranteed to be of highest grade tool steels ground to exacting tolerances. We feel that this complete line of chasers are the finest that we have produced in our 75 years of cutting tool manufacture. We think that you will agree with us.

THE HILL ACME COMPANY
ACME MACHINERY DIVISION
1203 West 65th Street • Cleveland 2, Ohio
CIRCLE INFORM-A-GRAM KEY NO. 1612

WHISTLER MAGNA-DIES
open the way to big savings

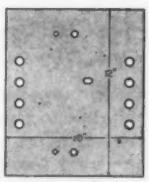
Over $2500 saved on these four typical jobs... Here's a specific example showing how Whistler Magnetic Perforating Dies are used and re-used to push die costs down to a rock bottom low:



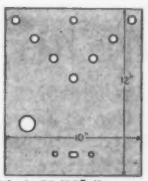


4 holes 1/2" dia.
2 holes 3/8" dia.
4 holes 3/16" dia.
Dim. tolerance ±.0005"

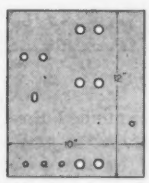
$106 SAVED ON JOB NO. 1...EVEN INITIAL INVESTMENT IS LESS
This Whistler Magna-Die unit includes a 12" x 14" die set, 10 punch and 10 die retainers, 10 punches, 10 die bushings, 10 strippers, 3 gages and one set of templets. The complete price with templets jig bored and gages mounted for producing the 10-hole part shown above: $819.00. The approximate cost of a custom die to do the same job: $925.00. From the very start, you start to save with a Whistler Magna-Die.



8 holes 1/2" dia.
2 holes 3/8" dia.
2 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dim. tolerance ±.0005"



1 hole 31/32" dia.
7 holes 1/2" dia.
1 hole 3/8" dia.
2 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dim. tolerance ±.0005"



6 holes 1/2" dia.
2 holes 3/8" dia.
4 holes 3/16" dia.
1 oval hole 3/8" x 1/2"
Dim. tolerance ±.0005"

$710 SAVED ON JOB NO. 2. All of the original punch and die parts (with the exception of 2 punches, 2 bushings and 2 strippers) are re-used here. The additional tooling required, plus bored templets with gages mounted, cost $389.79. The approximate cost of a custom die to produce this part: $1100. *Savings pile up with each succeeding job...$816 so far.*

$793 SAVED ON JOB NO. 3. Through the use of another punch and die retainer unit, a 31/32" punch, die bushing and stripper plus a new set of bored templets with gages, this part is produced at a die cost of $246.81. In this case, the cost of a custom die would amount to approximately $1040.00. *Savings now reach $1609.*

$925 SAVED ON JOB NO. 4. As more Whistler punch and die parts are accumulated, die costs for each succeeding job usually go down even further. Here, for example, only a new set of templets, jig bored to the 13-hole pattern, is needed. The cost: $163.55. A custom die for this job would run approximately $1089.00. Total savings for these first four jobs alone amount to approx. $2535.

EACH JOB CAN BE RE-RUN AT ADDED SAVINGS, TOO!

Punch and die parts can be quickly re-assembled to re-run any one of these four jobs. All it takes is approximately 10 minutes for press changeover. Whistler Magna-Dies cut downtime and remove production bottlenecks by avoiding the extra time required to obtain custom dies. They can be used on practically any press with a minimum shut height of 9½" for perforating materials up to and including ¼" mild steel.

GET COMPLETE DETAILS AND PRICES BY WRITING FOR CATALOG M-551

S. B. WHISTLER & SONS, Inc.
748 MILITARY ROAD, BUFFALO 23, N. Y.
Manufacturers of Adjustable, Magnetic and Custom Built Dies for All Industry
CIRCLE INFORM-A-GRAM KEY NO. 1613

The COST of a drill bushing depends on

MEN YOU SHOULD KNOW

The Famco Machine Company has announced the promotion of **Lowell Jensen** to works manager. He will be in charge of all production and take part in the development of new products. **Bernard Matter** has been appointed chief engineer and will be in charge of special and new design of Famco products.

•

Edward O. Falberg is now serving as manager of Bohn Aluminum & Brass Corporation's Greensburg, Ind. plant. He was formerly plant manager of three Bohn's Detroit plants.

•

Carl E. Sutherland Jr. has been named vice president in charge of production and engineering for the Skidmore-Wilhelm Mfg. Co. In this capacity he will direct production and engineering functions for both the company's products and production engineering departments.

•

The advancement of **Herbert C. Golz** to general manager has been announced by Elgin Metalformers Corp. He was formerly chief engineer. **Lawrence Fay** serves as chief engineer and **Emil Dragisic Jr.** was appointed plant manager.

The appointment of **Michael A. Horlak** to the position of new product research and development engineer for the Rotor Tool Co., has been disclosed.

•

C. H. Buddenbaum has been named works manager of the Lycoming plant of Avco Mfg. Corp. and is responsible for all manufacturing, plant and mechanical engineering.

•

Square D Co. has named **Lawrence G. Maechtlen** as first vice president.

•

Harry B. Dauphinais has been appointed general manager of Associated Spring Corp., William D. Gibson Co. Division in Chicago. He was formerly general manager of the corporation's Ohio Division.

•

General manager of Cleereman Machine Tool Corp. is **W. H. Jorgensen** and chief engineer for all engineering design, development, and research is **W. Gerald Tyson.**

•

Vice president in charge of manufacturing for Huck Manufacturing Co. is **Charles M. Albritton.** He was formerly plant manager for the company.

Herbert P. Fields has been appointed manufacturing manager of the Chicago plant of Hupp Aviation Co. after serving as manufacturing superintendent.

•

Walter E. Stewart has joined American Welding and Manufacturing Co. as manager of production engineering. In this newly-established position, he will coordinate the company's four main engineering divisions — industrial engineering, estimating, process engineering, and machine and tool design engineering.

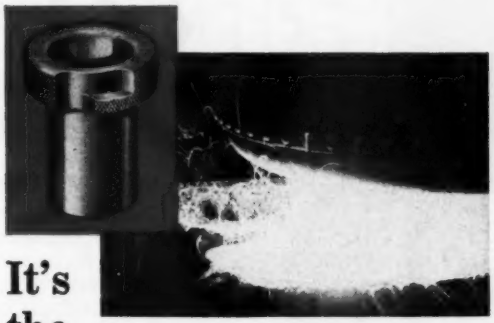
•

Hunter Spring Co. announces the appointment of **Stanley L. Albright** to the newly created post of manager of product planning. In addition, **James E. Hunt** has been serving as product planning engineer.

•

E. W. Bliss Co. announces changes in executive assignments. **William Staecker,** formerly chief engineer of the Canton Division, joins the general office staff as assistant manager of engineering for the company's Press Division. **Alfred Drain,** formerly project engineer, replaces Mr. Staecker as chief engineer of the Canton Division.

its working LIFE!



It's the *steel* in ACE drill bushings... *that makes the difference!*

When working life is doubled . . . bushing costs are cut in half! Fewer bushing changeovers add *bonus production savings!* That's why ACE drill bushings of new high-carbon chromium steel are being *specified exclusively* by cost-conscious tool men everywhere! Make a *working comparison* NOW with any other make bushing . . . and see "Positive Proof" that *the steel makes the difference!*

Write for the all new 1957 ACE Catalog and the name of your nearest distributor. DEPT. F-3

ACE DRILL BUSHINGS

ACE DRILL BUSHING CO., INC.
5407 FOUNTAIN AVE., LOS ANGELES, CALIF.
ACE DRILL BUSHING CO. [illegible] INC.
611 McCARTER HWY., NEWARK 5, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 163

MEN YOU SHOULD KNOW

Three manufacturing appointments have been announced by The Black & Decker Mfg. Co. **John M. Fox** serves as Hampstead plant manager, **Karl B. Salanda** is director of industrial and plant engineering, and **William B. Ford Jr.** is the Towson plant manager.

•

Promotion of two manufacturing executives at the Cleveland Division plant of Harris-Seybold Co. has been announced. **William G. Wells** assumes the newly created post of assistant division manager and **John E. Bauernschmidt** replaces him as works manager.

•

George W. Sinclair, works manager at the Tucson facility of Hughes Aircraft Co., was named plant manager, succeeding **Roy E. Wendahl** who takes over as vice president of sales at the Culver City headquarters. **John W. Black,** associate director of the Hughes guided missile laboratories in Culver City, has been named assistant plant manager at Tucson.

•

Matthew J. Betley has taken over as president of Titeflex, Inc.

New director of manufacturing of engineering for Chrysler Corp. is **John von Rosen.** He will be in charge of the corporation's production, industrial, and plant engineering activities. In the Stamping Division the following posts were made known: **Roy Blasiola,** plant manager, Mack Avenue Stamping Plant; **Walter B. Connolly,** plant manager, Outer Drive Stamping Plant, **T. W. Denomme,** factory manager, Russell-

•

Ferry and Meldrum plants; **Joseph D. Quinn,** division manufacturing engineer; **John W. Stump,** plant manager of the division interior trim unit; and **Herbert J. Winegarden,** division manager of quality control. **Ernest W. Marchand** has been appointed plant manager of the Plymouth Detroit Body Plant.

•

The appointment of **Alvin J. Jones** as director of engineering of the Motch and Merryweather Machinery Co. was announced by the company.

•

National-Standard Co. has appointed **Louis R. Berner** manager of operations at its Niles Plant. He has worked both in manufacturing and purchasing capacities with the company.

P. H. Richey, executive vice president of Wagner Brothers Inc. in Detroit, was named president and treasurer of the company's newly acquired, wholly-owned subsidiary, Automatic Molding Machine Co. of Los Angeles. Other new officials in the company are: **F. M. Mansfield,** vice president in charge of sales; **Bruno Leonelli,** vice president; **Irvin Tochner,** vice president in charge of operations; and **Mary P. Smeltzer,** assistant secretary.

•

H. M. Webber has been appointed manager of process engineering for Harper Electric Furnace Corp. He will direct an expanded program for the development and promotion of the Harper line.

•

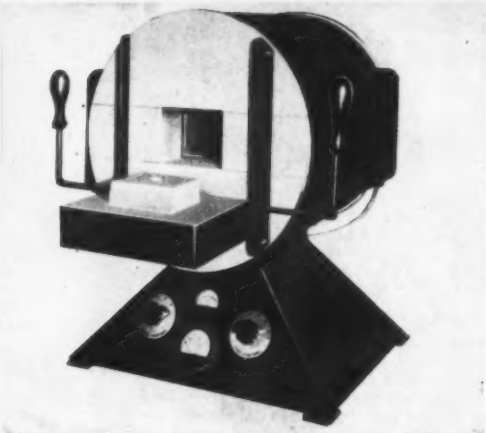
Chance Vought Aircraft, Inc. has announced the promotion of **Kelly G. Smith,** formerly chief tool engineer, to the position of quality control manager, and **George Gasper,** formerly assistant quality control manager, to the post of chief tool engineer.

•

Henry Kahn has been appointed quality control manager for Kurz & Root Co.

PRODUCTS

NEW DEVELOPMENTS · IMPROVEMENTS · COST AND TIME SAVERS

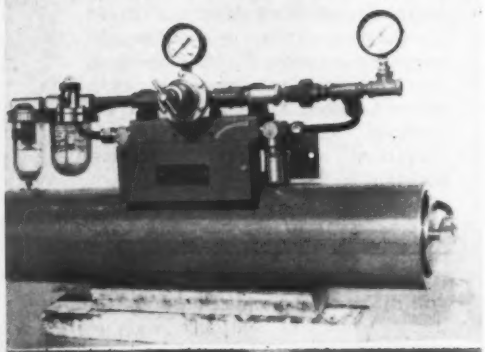


MUFFLE FURNACE . . .

Operations requiring temperatures to 2600° F can be performed by this muffle furnace. The self-contained unit has the temperature indicating and accurate control devices located in the furnace base. The heating chamber inside dimensions are 4⅛″ x 7″ x 2¾″. Hevi-Duty Electric Co., Milwaukee 1, or — **Circle No. A1.**

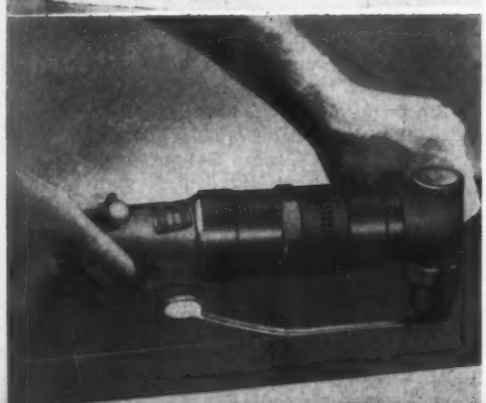
CLAMP . . .

A double-acting retracting clamp delivers pressure in two directions simultaneously. This clamp eliminates the use of two clamps for various types of holding. It is made of forged steel hardened and in three types of operation—hand knob, nut, and hand cam. Lodding, Inc., Worcester, Mass., or — **Circle No. A2.**



PUMP . . .

An improved extra heavy duty pneumatic booster pump has a boost ratio of 2.5 to 1, and an output of 2.5 cfm at 190 psi when using 80 psi input. When connected, Model H-6 automatically boosts the normal 80 psi air supply to approximately 200 psi. Dayton Rogers Mfg. Co., Minneapolis 7, or — **Circle No. A3.**

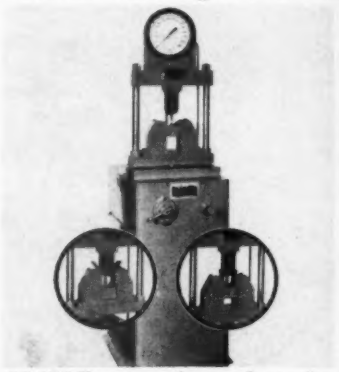


NIBBLER . . .

A nibbler is used on partially assembled products, or on large, cumbersome workpieces. It will cut ⅛″ mild steel or even ¼″ softer materials, like plastics, at the rate of 5″ to 6″ per min. Buckeye Tools Corp., 5015 Springboro Pike, Dayton 39, O., or — **Circle No. A4.**

TESTER . . .

Designed for guided bend testing with improved accuracy, faster testing, and greater convenience in operation in the guided bend tester. Model GB-124 has its own hydraulic load-applying means. The testing machine has



a 15,000 lbs capacity and employs a ½-hp motor. Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 38, or — **Circle Inform-A-Gram No. A5.**

AIR-COOLED RESERVOIR . . .

A combination hydraulic oil cooler and reservoir contains a radiator-like arrangement of tubes which, with the large headers, have a total usable capacity great enough to take the place of

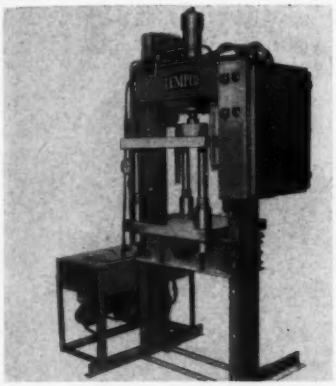
a conventional tank. The unit has a heat transfer rating of 12 hp with a capacity of only 5 qts. It is used for low volume requirements such as in portable hand-held tools and small machine tool attachments. The Rosaen Co., 176 E. Nine Mile Rd., Hazel Park, Mich., or — **Circle Inform-A-Gram No. A6.**

ON PARADE

Mail FREE Inform-A-Gram Card for MORE Details.

TRIM PRESS . . .

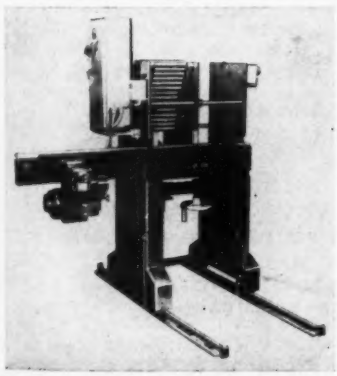
Fast approach and retraction speeds, and adjustable limit switches, controlling open and shut heights are some of the features of a die casting trim press. Model TP5-644 is designed for minimum maintenance with preloaded ball-bearing guided platen, ball-joint piston rod adapter, and self-priming pump.



Machine & Tool Div'n, Lempco Industrial, Inc., Bedford, O., or — **Circle Inform-A-Gram No. A7.**

MAGAZINE LOADER . . .

Feed long bars or tubing into centerless grinders, polishing machines, heat treating equipment, and other operations where parts are to be automatically fed in an end-to-end position with the magazine loader. Model 8000 can be adjusted to permit handling



of parts ¼" to 2¼" in dia and 3" to 24" long. Production Feeder Corp., 3130 Johnnycake Ridge Rd., Mentor, O., or — **Circle Inform-A-Gram No. A8.**

SHOE PADS . . .

Swivel toggle shoe pads can be used on any standard or stock screw without machining or altering of any kind. Screwzon pads are for any mechanical jaw where push-pull pressure is required. They are available in three sizes: 5/16", 3/8", and ½". Standard Parts Co., 1010 Broadway, Bedford, O., or — **Circle No. A9.**

DRILL PRESS VISE . . .

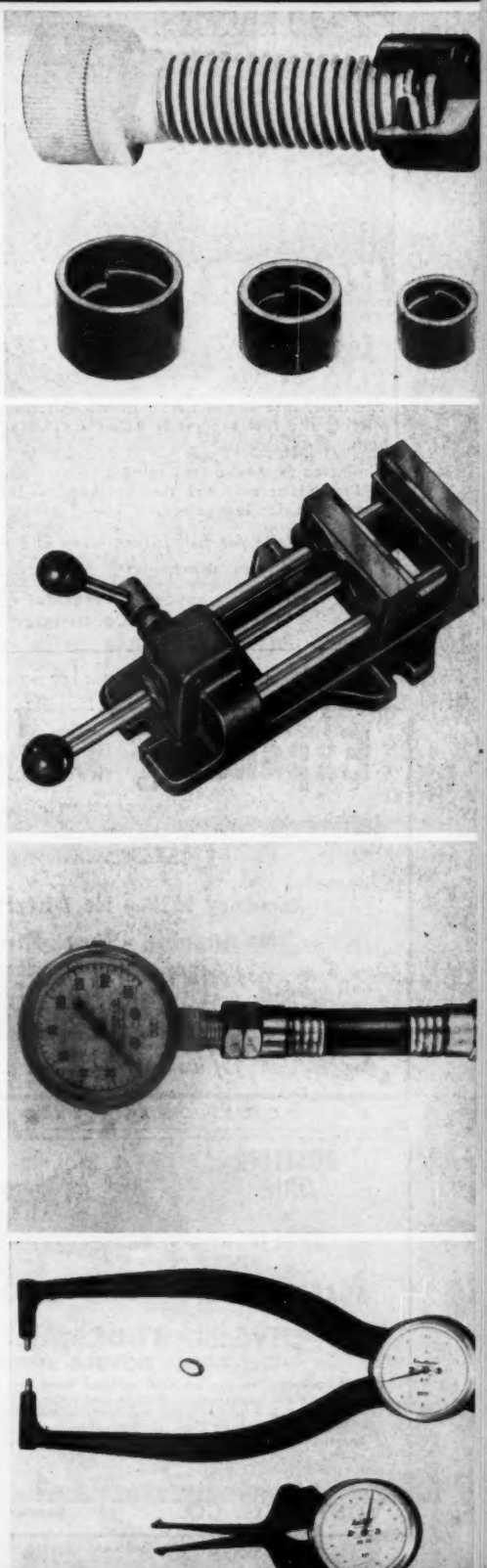
Both rigid and non-rigid work is handled without distortion by a drill press vise. A turn of the front adjusting screw bushing varies the jaw pressure from 1 to 1500 lbs. The Adjusto-Quick Control 4" drill press vise and fixture holder has a maximum opening of 5½". L-W Chuck Co., 72 S. St. Clair St., Toledo 4, O., or — **Circle No. A10.**

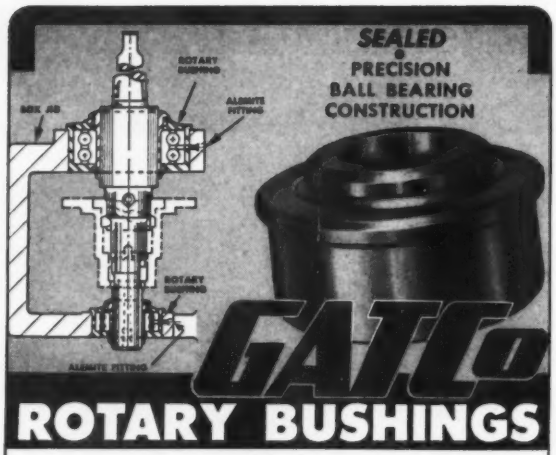
AIR GAGE PROTECTOR

Safeguard air gage mechanisms from sudden or variable air line pressures with a Gage/Gard. It has standard ¼" x ½" fittings and is attached between the existing air gage and the air supply line. The guard has a flexible neoprene body that absorbs most shock vibrations. Toolcraft Products Co., P. O. Box 92, S. Pasadena, Calif., or **Circle No. A11.**

CALIPER GAGES . . .

Measure small holes at deep depth, and hard to reach O ring grooves with a Quicktest dial caliper gage (bottom). The external model (top) measures thickness of steel and complex stampings. Titan Tool Supply Co., 1419 Hertell Ave., Buffalo 16, or — **Circle No. A12.**





ROTARY BUSHINGS

For DRILLING, CORE DRILLING, ROUGH and FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work — or both.

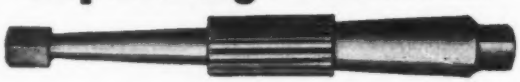
Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

Write for full information and prices

GATCO ROTARY BUSHING CO.
42322 ANN ARBOR RD., PLYMOUTH, MICH.
Telephone PLYMOUTH 1472

CIRCLE INFORM-A-GARM KEY NO. 1661

Expanding Mandrels



Accuracy 001" - No Distortion

No Slipping - Everlasting

K. O. LEE CO.
ABERDEEN, SOUTH DAKOTA

If it's made by **Lee** *it's a* **"Knock-Out"**

CIRCLE INFORM-A-GRAM KEY NO. 1662

POSITIVE GRIP • SPEED • ADAPTABILITY

Model J

AIR-POWERED TOOLMAKERS VISE

UNIVERSAL DOUBLE SWIVEL

Can be adjusted to any position without removing work from jaws. Furnished with hardened steel jaws and brass caps. Operated by a 6" air cylinder manufactured by Yost. Control kit included with each vise consisting of foot treadle valve, quick exhaust valve and 2 lengths of coupled hose. Jaws can be pre-set to any desired opening. Vise can also be operated manually. Jaw width — 4"; jaw opening — 6"; approx. wt. — 90 lbs.

Write today for bulletin on the complete Yost line

YOST MFG. CO., **Cambridge Springs, Pa.**

CIRCLE INFORM-A-GRAM KEY NO. 1663

HOLES JIG GROUND with *Vulcanaire*

Provide yourself with this inexpensive* instrument for use on your present equipment and JIG GRIND with a guarantee.

A five station indexing fixture from Vulcan's Contract Tool Room (Your tool room in Dayton).

Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts and of course hours of time.

*Vulcanaire equipment pays for itself on the first job.

{ Borrow our instructive 11 minute movie on Jig Grinding. }

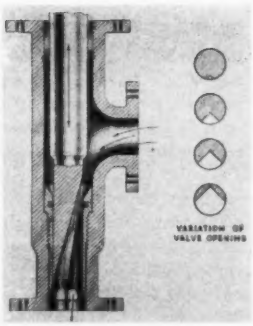
SERVICES OF YOUR TOOL ROOM IN DAYTON
ENGINEERING • PROCESSING • BUILDING • TOOLS
DIES • SPECIAL MACHINES • VULCANAIRE JIG
GRINDERS • MOTORIZED ROTARY TABLES • BREHM
"SHIMMY" AND RELATED DIES • AUTOMATION

VULCAN TOOL COMPANY
741 Lorain Ave., Dayton 10, Ohio

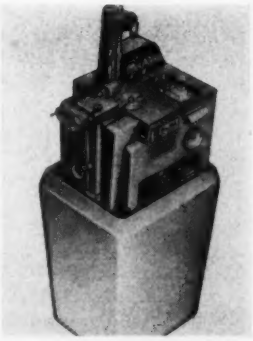
VULCAN tools

CIRCLE INFORM-A-GRAM KEY NO. 1664

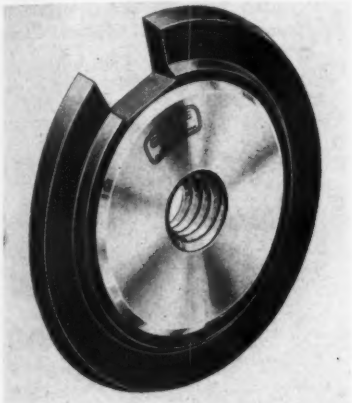
A Tapered Orifice Valve allows foreign particles up to twenty times larger than other types in the flow control system. The flow of fluid or gas is controlled by area of the tapered slot at the head of the opening. Variation of value openings are shown at the right. General-American Valve Co., P. O. Box 444, Corcna Del Mar, Calif., or —
Circle No. A13.



Check Fine Pitch Gears with an involute profile measuring instrument. The instrument, called Micrite (TM) is extremely accurate, sensitive, and simple to operate. An electrical measuring head has an easily adjustable contact-finger load range of from 3 to 30 grams. Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, or — **Circle No. A16.**

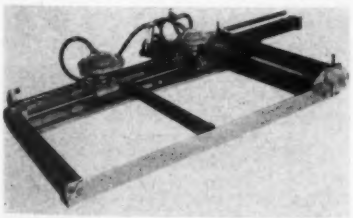


Save Time and Labor while improving work quality with a solid carbide circular cut-off blade for automatic screw machines. Chamfering is done simultaneously with cutting off because of the design, which



provides a chamfering edge in addition to the cut-off edge. The new tools are available with outside diameters from 1¾" to 3" and normal thicknesses, while specials can be made to order. Gay-Lee Co., Clawson, Mich., or —
Circle Inform-A-Gram No. A14.

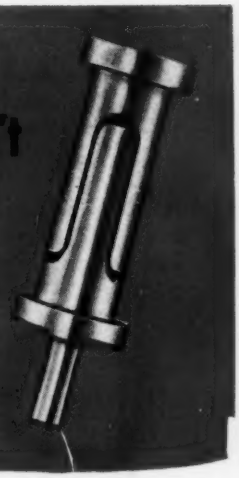
An Air Feed and Stock Leveller is used for feeding high finish coiled materials such as stainless steel, aluminum, plastics, etc. to punch presses. The Ses-Matic air feeds are



available in a variety of sizes for stock lengths from ½" to 36" long. No adjustments are required for various stock thicknesses. Special Engineering Service, Inc., 8161 Livernois Ave., Detroit 4, or —
Circle Inform-A-Gram No. A15.

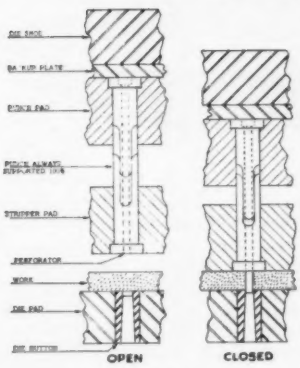
IF IT'S DURABLE IT'S DEPENDABLE

A Durable Perforator Can't KNUCKLE... BUCKLE... OR BEND...



Because . . .

WHEN PUNCHING IT IS 100% SUPPORTED BY A TELESCOPING SUPPORT-SLEEVE



Typical Installation

A Durable Perforator stays "alive" longer, because it is supported 100% the full stroke of its Telescoping Sleeve.

You get positive alignment, closer tolerances, burr free holes, regardless of the types of metal used. Holes are punched faster, easier and accurately.

Write For The New DURABLE ENGINEER'S HANDBOOK

121 pages showing 100 Practical Die Designs. NO CHARGE, NO OBLIGATION

Patented and made exclusively by

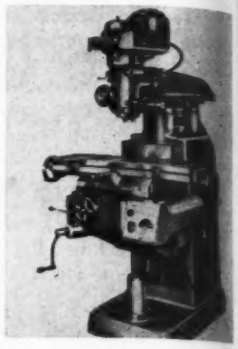
DURABLE PUNCH & DIE COMPANY

9030 South Hermitage St., Chicago 20, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 167

Measure Miniature Parts with higher accuracy with the Leitz Microscope. It uses a 200x magnification with an optical micrometer reading in 0.00005" in which 0.00001" can be safely and easily estimated. Measurements may be taken in x or y axis, by rotating ocular 90° against the stop. Opto-Metric Tools, Inc., 137 Varick St., New York 13, or — **Circle No. A17.**

A 1-HP Vertical Mill has been made available by Famco Machine Co., Kenosha, Wis. Famco 100 has a powerful precision built spindle and speed changes can be made while the spindle is running. Speed changes from 120 rpm to 4300 rpm or an optional speed range from 75 to 2800 rpm are available. There is also a 2-hp vertical milling machine.
Circle No. A18.



ACE
GROUND-FROM-THE-SOLID
DRILLS

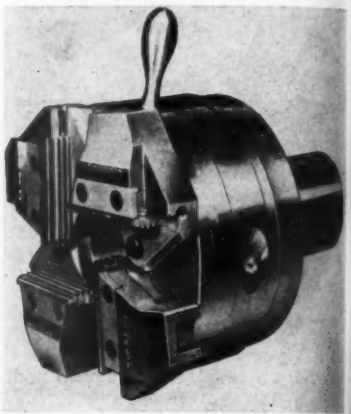
Right you are when you specify Ace Ground-from-the-Solid Drills! Chances are you'll find the expanded Ace line includes standard stock drills that are tailor-made for your job. Long ones, short ones. Big ones, small ones. Drills made of top quality, uniformly hardened high speed steel. Carbide tipped and solid carbide drills, too. What's more, you'll find that every Ace drill is *pointed right* for you . . . finished with highly polished flutes and stronger, keener cutting edges that resist wear and breakage, stay on the job longer. So be right, buy right . . . specify "Ace".

Call your local distributor or write direct today for the latest Ace Drill Catalog and current Net Price Schedule.

ACE DRILL
ADRIAN, MICHIGAN
Originators of Ground-from-the-Solid High Speed Steel Drills

Taper Length Drills	Stub Length Drills	"Hi-Brinell" Drills	Carbide Tipped Drills
12"-18" Longboy Drills	Heavy Duty Drills	Solid Carbide Drills	Step and Subland Drills
Hardened H.S.S. Blanks	Slow Spiral Drills	Taper Shank Drills	"L" and "M" Plastic Drills
General Purpose Drills	Fast Spiral Drills	Chucking Reamers	Drill Length Reamers

A Series of 3" and 4" Landmatic heat treated, stationary type, die heads has recently been developed by the Landis Machine Co., Waynesboro, Pa. These self opening heads, designated type A, are designed to produce threads to class 3 tolerances.



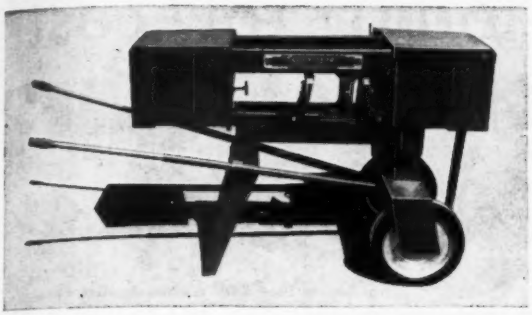
Replacing the Z type series, these heads feature chrom-moly alloy steel construction, heavier head opening springs to facilitate easier closing and faster head opening action, and four sets of hardened pins and bushings.
Circle Inform-A-Gram No. A19.

Dril Sheet Metal, stainless steel and other materials with high speed utility drills. Points are split with 1.350 angles which makes the drill start right in and not walk. It is

available in right or left hand fractional sizes of 3/64" through ½" and wire gage sizes 1 through 60. Chicago-Latrobe, 411 W. Ontario St., Chicago 10, or —
Circle Inform-A-Gram No. A20.

TAKE IT TO THE JOB...

KALAMOBILE —a metal-cutting band saw that's truly portable—handier than ever!



Here's the popular Kalamazoo Model 610 metal-cutting band saw on the handiest chassis you ever saw. Provides greatly increased portability with its rubber-tired 12-inch wheels and telescoping handles. One man shifts the 610 from job to job with ease. Capacity 6" Rounds—10" Flat.

610-D without coolant attachment.
610-W with coolant attachment.
Kalamobile chassis M6A fits all 610 models.

MACHINE TOOL DIVISION

Kalamazoo TANK and SILO CO.

4221 Harrison Street, Kalamazoo, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1691

FOR FASTER GRINDING at LOWER COST

The exclusive B-60 Bond used in A.I.T. bonded diamond wheels has been field tested in over 400 plants. We can *prove* these superior advantages to you in YOUR plant:

- Faster grinding
- Up to 40% longer wheel life
- One grit size wheel can be used to hog and finish—for extra savings.
- Wheel grinds cooler—does not fracture carbide
- Corners stay sharper longer
- No re-dressing of diamond surface
- NEW BACKING dissipates heat faster
- No down-time for dressing inside body section

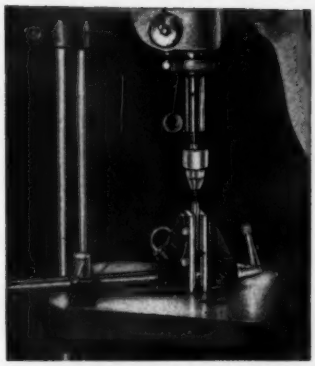
Write today for new, FREE catalog and prices

A.I.T. Diamond Tool co.

9217 N. KIMBALL AVE.
SKOKIE, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1692

You need both on your drill press



Step Up Production with Two AMF Tools

The AMF *Wahlstrom Chuck* will help change tools in seconds, safely. The *fully-automatic* Wahlstrom makes it possible to drill, ream, counterbore with *one spindle* and without moving work. No keys, collets or wrenches.

The AMF *Float-Lock Vise* turns a drill press into a complete machine tool. Easy to mount—in minutes. Horizontal and vertical "V" grooves align and grip rounds securely for end drilling and centering. Many other uses on every set-up.

Write for details and name of nearest distributor.

AMF Tool Division
AMERICAN MACHINE & FOUNDRY COMPANY
224 Glenwood Avenue, Bloomfield, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1693

FREE... 64 PAGE CATALOG

WORLD'S LARGEST LINE OF WORK HOLDING EQUIPMENT—CHUCK JAW BLANKS, CAST ALUMINUM AND MALLEABLE KNOBS, WHEELS, HANDLES—PLUS HUNDREDS OF OTHER JIG AND FIXTURE COMPONENTS

COMPLETE DETAILED SPECIFICATIONS
ENGINEERING DRAWINGS • COST SAVING DATA
write for your copy—TODAY!

JERGENS TOOL SPECIALTY CO.
Dept. TP-12 712 E. 163rd St., Cleveland 10, Ohio

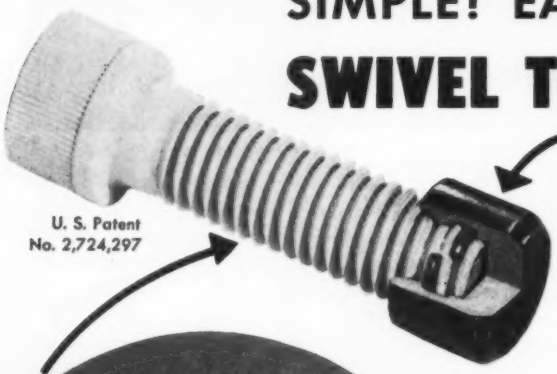
CIRCLE INFORM-A-GRAM KEY NO. 1694

New SCREWZON® Pads

SIMPLE! EASY-TO-USE! LOW COST!

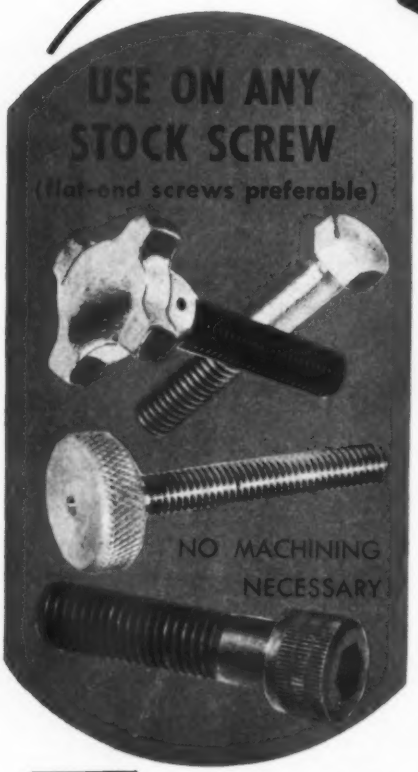
SWIVEL TOGGLE SHOE CLAMPS

Screws On! Stays On!

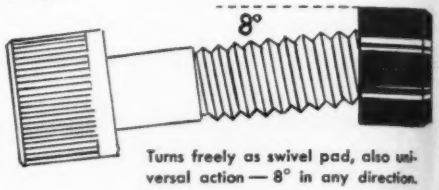


U. S. Patent
No. 2,724,297

The new SCREWZON Swivel Toggle Shoe Pads are the simplest, cheapest, most satisfactory clamps available anywhere! They can be used on ANY SCREW, standard or stock (flat end screws preferable). No machining necessary—NO altering. For any mechanical jaw where "push-and-pull" pressure is required. The new, patented SCREWZON Pads will save you time, trouble and money. Order today!



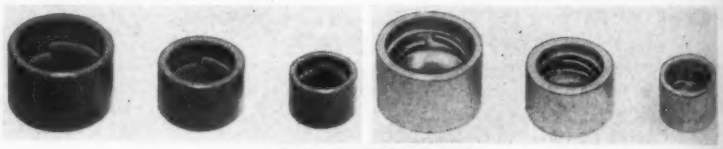
CUTAWAY VIEW OF SCREWZON above, shows the spring insert in each pad. This holds the screw on, but permits free swivel action—8° in any direction.



Turns freely as swivel pad, also universal action — 8° in any direction.

HEAT TREATED—BLACK OXIDE

SOFT-CADMIUM PLATED



O. D. ARE STANDARD

"SCREWZON" SWIVEL TOGGLE SHOE PADS
PRICES AND SPECIFICATIONS

	Screw Size	Code	O.D.	Length	100 to pkg. price each	Price per doz.
HARDENED BLACK OXIDE	5/16-18	SPH312	.437	5/16"	23¢ ea.	$3.48 doz.
	3/8-16	SPH375	.562	3/8"	31¢ ea.	4.44 doz.
	1/2-13	SPH500	.687	1/2"	39¢ ea.	5.64 doz.
NOT HARDENED CAD. PLATED	5/16-18	SPS312	.437	5/16"	22¢ ea.	3.36 doz.
	3/8-16	SPS375	.562	3/8"	30¢ ea.	4.32 doz.
	1/2-13	SPS500	.687	1/2"	38¢ ea.	5.52 doz.

OTHER SIZES ON APPLICATION QUANTITY PRICES ON APPLICATION

Screwzon Pads can be press fitted in any jaw.

FREE CATALOG — *Write for Your Copy!*

Standard Parts Company offers the most complete line of fine quality tool room standards available today. All Standard components incorporate the latest safety, efficiency and performance features desired by the trade. You can depend on Standard Components . . . they will never let you down. Our New Sixth Edition CATALOG—covering our complete line—is now ready for you. Tracing sheets are available.

STANDARD PARTS CO.

1002 BROADWAY · BEDFORD, OHIO · BEDFORD 2-2800

CIRCLE INFORM-A-GRAM KEY NO. 170

INFORM-A-GRAM

DECEMBER 1957 ISSUE

DO NOT USE THIS CARD AFTER FEB. 28, 1958

TOOLING and PRODUCTION:

Please have information on items circled sent to me.

YOUR NAME _____ YOUR TITLE _____
(Please Print or Typewrite)

COMPANY NAME _____

COMPANY ADDRESS _____

CITY _____ ZONE _____ STATE _____

(Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.)

ADVERTISEMENTS

2	22	41	60	113	142	178	1143	1304	1494	1576	1692	1792	1901	2021
3	23	43	61	115	143	181	1144	1305	1501	1581	1693	1793	1902	2022
4	24	44	62	116	145	182	1145	1401	1502	1582	1694	1794	1903	
5	25	45	63	117	147	185	1146	1402	1503	1583	1721	1795	1931	
6	26	46	64	118	148	186	1201	1403	1504	1584	1722	1801	1932	
7	27	47	65	119	151	187	1202	1411	1505	1601	1723	1802	1933	
8	28	48	66	121	152	188	1203	1412	1531	1602	1724	1803	1941	
9	29	49	67	123	155	191	1204	1413	1532	1603	1751	1831	1942	
10	30	50	68	125	156	192	1221	1441	1533	1604	1752	1832	1943	
11	31	51	69	127	159	195	1222	1442	1541	1605	1753	1833	1944	
12	32	52	70	129	163	196	1223	1443	1542	1611	1754	1834	1945	
13	33	53	72	131	167	250	1241	1444	1543	1612	1755	1841	1971	
15	34	54	105	132	168	300	1242	1461	1544	1613	1756	1842	1972	
16	35	55	106	133	170	1111	1243	1462	1571	1661	1761	1843	1973	
17	36	56	107	134	171	1112	1244	1463	1572	1662	1762	1891	1974	
18	37	57	108	135	173	1113	1301	1491	1573	1663	1763	1892	1975	
19	38	58	109	136	174	1141	1302	1492	1574	1664	1764	1893	1976	
21	40	59	112	138	177	1142	1303	1493	1575	1691	1791	1894	1977	

EDITORIAL ITEMS

A1	A19	A37	A55	A73	B14	B32	B50	C6
A2	A20	A38	A56	A74	B15	B33	B51	C7
A3	A21	A39	A57	A75	B16	B34	B52	C8
A4	A22	A40	A58	A76	B17	B35	B53	C9
A5	A23	A41	A59	A77	B18	B36	B54	C10
A6	A24	A42	A60	B1	B19	B37	B55	C11
A7	A25	A43	A61	B2	B20	B38	B56	D1
A8	A26	A44	A62	B3	B21	B39	B57	
A9	A27	A45	A63	B4	B22	B40	B58	
A10	A28	A46	A64	B5	B23	B41	B59	
A11	A29	A47	A65	B6	B24	B42	B60	
A12	A30	A48	A66	B7	B25	B43	B61	
A13	A31	A49	A67	B8	B26	B44	B62	
A14	A32	A50	A68	B9	B27	B46	C1	
A15	A33	A51	A69	B10	B28	B48	C2	
A16	A34	A52	A70	B11	B29	B47	C3	
A17	A35	A53	A71	B12	B30	B49	C4	
A18	A36	A54	A72	B13	B31	B49	C5	

Which article in this issue was of most interest to you? _____

THESE INFORM-A-GRAM CARDS are for the convenience of *TOOLING and PRODUCTION* readers who, we know, rarely have stenographic help at their beck-and-call while reading. To get further information concerning selected items featured — all one needs is an INFORM-A-GRAM card and a pencil or pen to circle the numbers of the items wanted. If there is no identifying number, use the page number.

Our reader service department is handling over 100,000 reader inquiries per year and it is essential that the blanks at the top of each card be filled in accurately and completely. Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.

INFORM-A-GRAM

DECEMBER 1957 ISSUE

DO NOT USE THIS CARD AFTER FEB. 28, 1958

TOOLING and PRODUCTION:

Please have information on items circled sent to me.

YOUR NAME _____ YOUR TITLE _____
(Please Print or Typewrite)

COMPANY NAME _____

COMPANY ADDRESS _____

CITY _____ ZONE _____ STATE _____

(Please use only one of these INFORM-A-GRAM cards for yourself and let one of your associates use the other.)

ADVERTISEMENTS

2	22	41	60	113	142	178	1143	1304	1494	1576	1692	1792	1901	2021
3	23	43	61	115	143	181	1144	1305	1501	1581	1693	1793	1902	2022
4	24	44	62	116	145	182	1145	1401	1502	1582	1694	1794	1903	
5	25	45	63	117	147	185	1146	1402	1503	1583	1721	1795	1931	
6	26	46	64	118	148	186	1201	1403	1504	1584	1722	1801	1932	
7	27	47	65	119	151	187	1202	1411	1505	1601	1723	1802	1933	
8	28	48	66	121	152	188	1203	1412	1531	1602	1724	1803	1941	
9	29	49	67	123	155	191	1204	1413	1532	1603	1751	1831	1942	
10	30	50	68	125	156	192	1221	1441	1533	1604	1752	1832	1943	
11	31	51	69	127	159	195	1222	1442	1541	1605	1753	1833	1944	
12	32	52	70	129	163	196	1223	1443	1542	1611	1754	1834	1945	
13	33	53	72	131	167	250	1241	1444	1543	1612	1755	1841	1971	
15	34	54	105	132	168	300	1242	1461	1544	1613	1756	1842	1972	
16	35	55	106	133	170	1111	1243	1462	1571	1661	1761	1843	1973	
17	36	56	107	134	171	1112	1244	1463	1572	1662	1762	1891	1974	
18	37	57	108	135	173	1113	1301	1491	1573	1663	1763	1892	1975	
19	38	58	109	136	174	1141	1302	1492	1574	1664	1764	1893	1976	
21	40	59	112	138	177	1142	1303	1493	1575	1691	1791	1894	1977	

EDITORIAL ITEMS

A1	A19	A37	A55	A73	B14	B32	B50	C6
A2	A20	A38	A56	A74	B15	B33	B51	C7
A3	A21	A39	A57	A75	B16	B34	B52	C8
A4	A22	A40	A58	A76	B17	B35	B53	C9
A5	A23	A41	A59	A77	B18	B36	B54	C10
A6	A24	A42	A60	B1	B19	B37	B55	C11
A7	A25	A43	A61	B2	B20	B38	B56	D1
A8	A26	A44	A62	B3	B21	B39	B57	
A9	A27	A45	A63	B4	B22	B40	B58	
A10	A28	A46	A64	B5	B23	B41	B59	
A11	A29	A47	A65	B6	B24	B42	B60	
A12	A30	A48	A66	B7	B25	B43	B61	
A13	A31	A49	A67	B8	B26	B44	B62	
A14	A32	A50	A68	B9	B27	B46	C1	
A15	A33	A51	A69	B10	B28	B48	C2	
A16	A34	A52	A70	B11	B29	B47	C3	
A17	A35	A53	A71	B12	B30	B49	C4	
A18	A36	A54	A72	B13	B31	B49	C5	

Which article in this issue was of most interest to you? _____

FIRST CLASS
PERMIT No. 7879
CLEVELAND, O.

BUSINESS REPLY CARD

No Postage Stamp Necessary If Mailed in the United States

5c POSTAGE WILL BE PAID BY

TOOLING & PRODUCTION MAGAZINE

P. O. BOX 3505

CLEVELAND 18, OHIO

FIRST CLASS
PERMIT No. 7879
CLEVELAND, O.

BUSINESS REPLY CARD

No Postage Stamp Necessary If Mailed in the United States

5c POSTAGE WILL BE PAID BY

TOOLING & PRODUCTION MAGAZINE

P. O. BOX 3505

CLEVELAND 18, OHIO

Why pay the price for CUSTOM-MADE DIES...

when you can easily assemble the shapes you need

from A-L COMPOSITE DIE SECTIONS

Automobile door panel trim die assembled from A-L Composite Die Sections. Cutting edges are hardened to 58-60 Rockwell C.

SEND FOR THIS NEW CATALOG "FORGING AND CASTING PRODUCTS"

Contains the latest information on FCC Air Hardening, Oil Hardening and other Cast-To-Shape Tool Steel Specialties that can save you time and money . . . also Composite Die Sections and Smooth Hammered Forgings in a wide range of tool and stainless steels. *Don't wait—get your copy NOW.*

Write Today

ADDRESS DEPT. TP-96

Dies can be assembled from A-L Composite Die Sections to blank, trim, bead or do any job requiring the cutting of sheet metal to regular or irregular shapes. Thousands of die shapes are possible from combinations of the thirty-five standard sections carried in stock. Thus, you save the time and trouble of machining custom-made sections from solid stock and minimize the waste of valuable tool steel.

These standard sections . . . made in a variety of water hardening tool steel grades . . . are electrically butt welded by a special process to non-hardenable mild steel bases. Because the base always remains soft, screw and dowel holes are easily drilled after the tool steel edges have been machined and heat treated.

Ask your Allegheny Ludlum representative about this money-saving method of die making . . . or write *Allegheny Ludlum Steel Corporation, Forging and Casting Division, Wanda and Jarvis Aves., Detroit 20, Mich.*

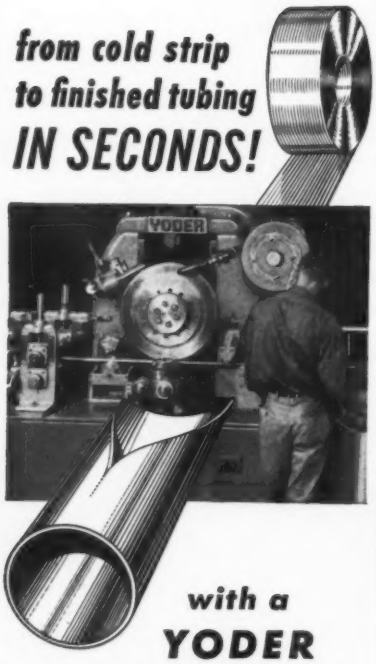
For complete MODERN Tooling, call Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

W&W 6079

CIRCLE INFORM-A-GRAM KEY NO. 171

from cold strip to finished tubing IN SECONDS!



with a

YODER ELECTRIC-WELD TUBE MILL

One of the fastest . . . and one of the least expensive . . . methods of making steel tubing is with a Yoder Electric-Weld Tube Mill. The Yoder method eliminates the need for time-consuming heat treatments and costly conditioning furnaces for most tube needs. Scrap losses, too, are far lower than any other method . . . usually less than 2%.

The Yoder Type-M Mill shown above is operated by one man and a helper. Coiled strip on this mill is continuously cold-roll formed, welded and cut to required lengths in a matter of seconds . . . at speeds up to 340 f.p.m. The quality of the resulting tube is *constantly* better than the requirements of commercial standards. This is one of many reasons why manufacturers and users of tubing the world over are using more Yoder mills than all other makes combined.

If your business requires pipe and tubing, ferrous or non-ferrous, in sizes from ¼-inch up to 26-inch diameter, Yoder can supply the engineering service and machines to produce it faster and better for less! For complete details, write for the Yoder Tube Mill Manual. It's yours for the asking.

THE YODER COMPANY
5501 Walworth Ave. • Cleveland 2, Ohio

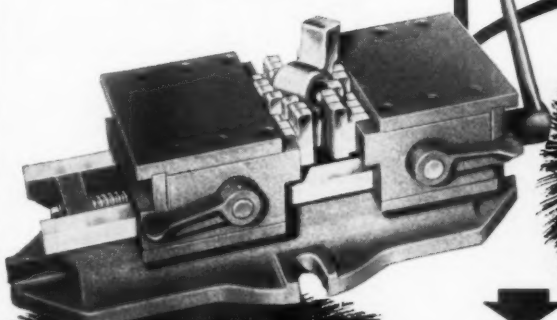
ENGINEERING YODER MANUFACTURING — PIPE AND TUBE MILLS (ferrous or non-ferrous)

CIRCLE INFORM-A-GRAM KEY NO. 1721

NEW

Contour Gripping FIXTURE

SAVES YOU MONEY!



CUTS SPECIAL FIXTURE COSTS

INSTANTLY GRIPS AND HOLDS ANY ODD SHAPED PIECE

TAKE BIGGER CUTS
- FASTER
- SAFER
- CHEAPER

THOUSANDS OF USES

This amazing fixture holds any shape in any position . . . for drilling, milling, shaping or grinding. It only has to be set once to take identical pieces for any operation on all types of machine tools.

Investigate its possible application in your business. Write for further details or demonstration.

NO MORE BLOCKING SHIMMING HOLDS ANY SHAPE IN ANY POSITION

WRITE for Further Information Today

Act Now!

AMPOGRIP CORP.

10-T Olivine Street • Willimansett • Mass.

CIRCLE INFORM-A-GRAM KEY NO. 1722

Monarch Precision SHAPLANE Radius Tools
Illustration shows convex cutter for ¼" to 2½" balls.

FIVE MODELS for LATHES, SHAPERS, PLANERS, BORING MILLS

Range ½" to 3" for concave Radii. Also heavy duty models for radii to 6" on planers, etc.

PATENT PENDING

Write for circular

C. B. TEETER, TOOL ROOM SPECIALTIES
1221 W. Addison St., Chicago 13, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1723

DYKEM STEEL BLUE

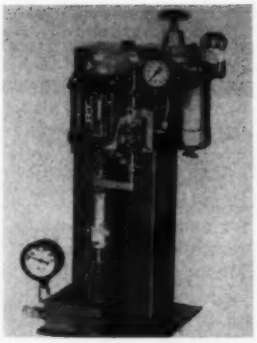
Stops Losses making Dies and Templates

Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead
THE DYKEM COMPANY
2303L North 11th St. • St. Louis 6, Mo.

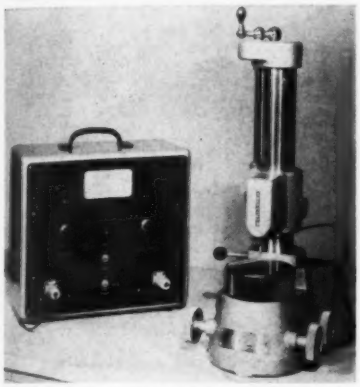
CIRCLE INFORM-A-GRAM KEY NO. 1724

An Air Automatic Air-Hydraulic Converter handles a range of hydraulic requirements for heavy and light industrial applications. The unit will operate at air pressures as low as 5 psi minimum to 100 psi maximum. Five standard models cover a range of requirements. Renco-Toledo, Inc., 3358 Alexis Rd., Toledo 13, or — **Circle No. A21.**



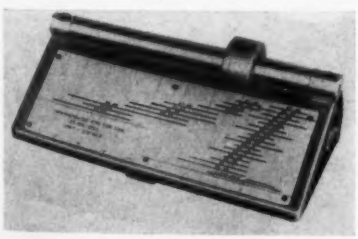
Drill Small Holes in hard to reach locations with Mindril. It has a special gripping mechanism, into which the drill is inserted, permitting quick, easy changing of dull or broken drills. No soldering or brazing is necessary. It will hold drill sizes ranging from #80 to #57 or 1/63" and 1/32". Ritmar Corp., 183 New York Ave., Huntington, L. I., N. Y., or — **Circle No. A24.**

An Electronic Gage Block Checker that eliminates time-consuming operations in obtaining ultra precise dimensional measurement is one of the Eli Whitney line of gage checking laboratory instruments. This



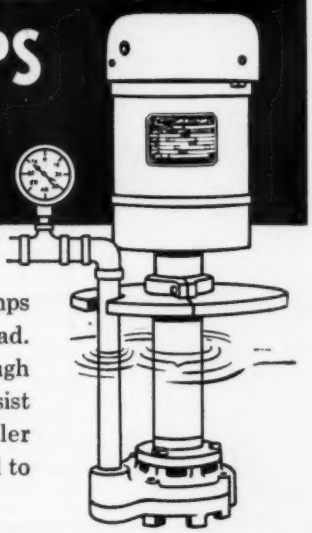
line is designed for use in gage, metrology, and standards laboratories. The unit eliminates the clamping and unclamping and repositioning formerly required. The Sheffield Corp., Dayton 1, O., or — **Circle Inform-A-Gram No. A22.**

The Limits and Fits Demonstration Unit is a device that provides the actual feel of a fit between shafts and holes of matching cylindrical parts. It is of particular value to designers and draftsmen and will assist in



avoiding unnecessarily close tolerances. All scales can be used without modification and their interchange may be quickly and easily carried out. Engis Equipment Co., 431 S. Dearborn St., Chicago 5, or — **Circle Inform-A-Gram No. A23.**

Need Pressure AND Volume? these GRAYMILLS Superflo COOLANT PUMPS give you BOTH!



These compact, dependable coolant pumps can give you up to 10 GPM *at* 65 ft. head. They provide abundant flow even through a maze of pipes and fittings. They resist wear and binding because the impeller floats on a cushion of liquid – no metal to metal contact, no seals, no packing.

Even if you don't need this "high head" performance, you'll find Standard Superflos for every normal need from 1/25 to 1½ H.P.

Model 30JH-1 1 HP – Various Lengths. 10 GPM at 65' head. Amazingly compact. Interchangeable with ¼ HP Models.

145

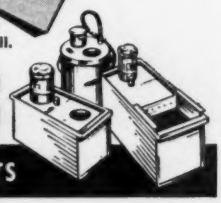
Pumps only or complete pumping units with tanks. Sold by leading Industrial Distributors everywhere. Graymills representatives near you are ready to help with special problems.

WRITE FOR THIS NEW CATALOG 56JH

Showing standard and JIC model centrifugal and gear type Pumps, Pumping Units, Accessories and helpful selection chart.

GRAYMILLS CORPORATION
3713 N. Lincoln Ave., Chicago 13, Ill.

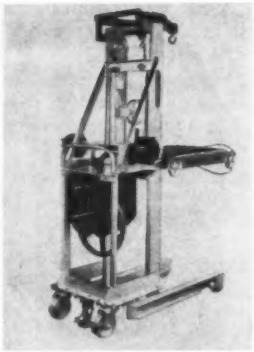
GRAYMILLS



Superflo COOLANT PUMPS AND UNITS

CIRCLE INFORM-A-GRAM KEY NO. 173

Extra Heavy Die Handler for lifting and moving dies and heavy machinery is available in 1000 and 2000 lb capacities. Called the DX shoplifter, the unit lifts to 54" and has an overall height of 80". A foot-operated floor lock holds the lifter securely during loading or unloading. Economy Engineering Co., 4509 W. Lake St., Chicago 24, or —
Circle No. A25.

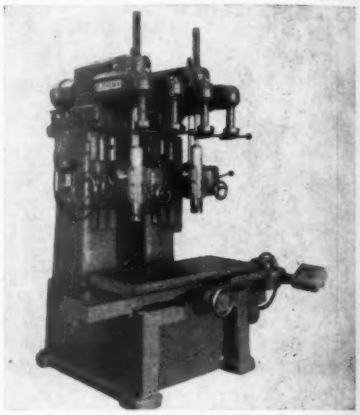


An Abrasive Wheel composed of thousands of narrow abrasive strips, produces a highly resilient brushing action. This wheel exerts more exact control in working complex contours and curvatures without flatting or digging. It is used for polishing, deburring, and removal of surface flaws. Merit Products Inc., 3691 Lenawee Ave., Los Angeles 16, or —
Circle No. A26.

ARMSTRONG
Quality TOOLS
More than meets the eye
There are extra values in ARMSTRONG TOOLS that become apparent only with use.
TOOL SENSE — convenience in use — the most efficient "tool approach" built into ARMSTRONG Tool Holders; the balance and "feel" of an ARMSTRONG Wrench; the rigidity of ARMSTRONG "C" Clamps; the extra toughness of ARMSTRONG Lathe Dogs and Eye Bolts; the universal adaptability of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.
STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra strength — strength beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.
UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.
Write for Catalog
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5220 WEST ARMSTRONG AVE. · CHICAGO 30, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 174

Bore Two Similar Pieces at the same time with either the same or different size holes with this boring and drilling machine. The table moves in equal relationship to each spindle and the possibility of hole



spacing errors is completely eliminated. The table is 20" x 51" with a travel of 15" x 24". This allows a hole spacing up to 50". Cleereman Machine Tool Corp., 555 W. Washington Blvd., Chicago 6, or —
Circle Inform-A-Gram No. A27.

A Tapping Attachment is compact and lightweight. The Model Tapmatic 100 weighs only 10 ozs, has a maximum diameter of 1⅝", and a

maximum length of 3½". Rated capacity for tapping in steel is from #00 to #6. Tapmatic Corp., 845 W. 16th St., Costa Mesa, Calif., or —
Circle Inform-A-Gram No. A28.

You Can Rely on a **ROUSSELLE**

THESE 40-TON PRESSES take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are *very moderately priced.*

Significant savings may result if you let our engineering staff assist you. There is no obligation.

●

Rousselle Presses are sold exclusively through leading machinery dealers.

●

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

SERVICE MACHINE CO. 2310 West 78th Street • Chicago 20, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 1751

REID TOOL ROOM *Accessories*

BALL HANDLES — Threaded

Designed for machine tools, jigs, fixtures, shift lever handles etc. and give your product that "dressed-up" appearance. Made in a wide variety of diameters and thread sizes. Round and oval plastic available in red and black. Steel ball handles are turned from bar stock. Highly polished. Low prices and the finest quality.

Also clamping handles, C.I. Hand knobs, Mall. mach. handles, compression springs, hand wheels and many other accessories and components at low prices.

Quality at Moderate Prices!

FREE 64 Page Catalog

REID TOOL SUPPLY CO. Muskegon Heights, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1752

Anything... **in THROW-AWAY *INSERTS***

CARBIDE, CERAMIC, HSS and OXIDE

Viking

Throw-Away Inserts, all Sizes and Types in any quantity -- Our Specialty

Send prints for quotations on Negative and Positive rake Inserts. Standard Inserts carried in stock for IMMEDIATE SHIPMENT.

Write for Catalog and Bulletins.

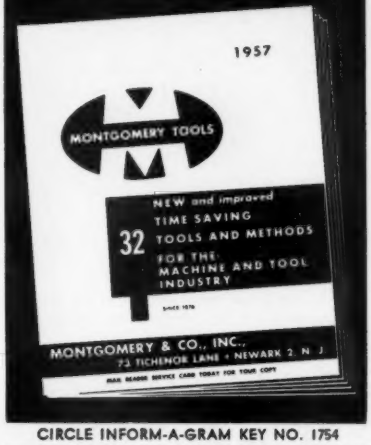
THE VIKING TOOL COMPANY, INC.

Cutting Tool Engineers and Manufacturers

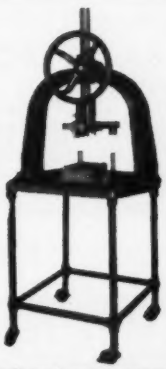
100 NICHOLS ROAD SHELTON, CT.

CIRCLE INFORM-A-GRAM KEY NO. 1753

free!



CIRCLE INFORM-A-GRAM KEY NO. 1754



COMPLETE THE DIE-SET AT YOUR BENCH

Lacey Die-Set Machine

Here's a truly "one man" press. It operates with one hand. Handy for tool and press rooms, it permits the die-maker to complete a die-set at his bench . . . saves toolroom and handling costs. Ask today for full details.

Sole Distributors

MOORE SPECIAL TOOL CO., INC.
726 Union Avenue Bridgeport 7, Conn.

CIRCLE INFORM-A-GRAM KEY NO. 1755

Empire

LIVE CENTERS

ARE
• ACCURATE • VERSATILE
• HEAVY DUTY

Manufactured in all tapers. 1 to 6 MT in stock. Special shanks and points made to order.

THE TAPERED SEAT ASSURES ACCURACY OF ± .0001

PAT. PEND.

Points illustrated are standard.

Ask your Supplier or Write for Literature

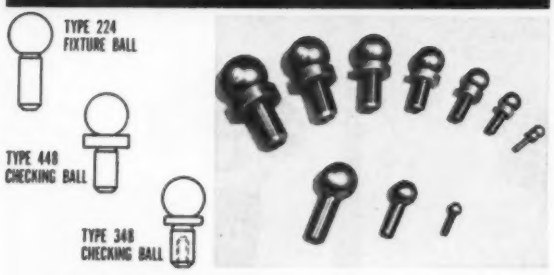
ROYAL PRODUCTS

88 UNION ST. MINEOLA, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1756

High-Precision Stainless Steel

TOOLING BALLS



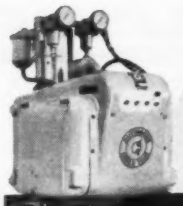
- For gage, jig and tool work. Center of ball provides positive reference point for work in any plane.
- Highly accurate. Ball size held to ±.0001" for fixture balls; ±.00002" for checking balls.
- Durable; corrosion-resistant. Made of Type 440-C stainless steel, hardened to 55-58 Rockwell C.
- In stock: Types 224 and 448 in 7 ball sizes, ¼" through 1" by ⅛" steps; Type 348 with ½" ball and 6-32 tapped shank. Other sizes to order.

WRITE FOR price list and ASTE Data Sheet.

INDUSTRIAL TECTONICS, Inc.
3698 Jackson Rd., Ann Arbor, Michigan
18315 Santa Fe Ave., Compton, California

PRECISION BALLS OF ANY SIZE OR MATERIAL
ANTI-FRICTION BEARINGS FOR SPECIAL REQUIREMENTS
TOOLING BALLS — MASTER BALLS — SPHERICAL FINISHING

CIRCLE INFORM-A-GRAM KEY NO. 1761



Now! **MARK**
FLAT, ROUND, CONTOURED SURFACES *at* HIGH SPEEDS!

MARKS ANY SHAPE

WITH
Automark
(MODEL HRMA)
ROLL MARKING MACHINE

Here is speed, versatility and adaptability in a Marking Machine that operates by air pressure and that is controlled electrically. Marks any shape material... round, flat or contoured.

CUTS PRODUCTION COSTS... GREATLY INCREASES OUTPUT

The Automark operates at speeds up to 6,000 or more 1-inch strokes per hour, or 1,400 strokes per hour on stroke of ram and die slide combination. Think of all the saving in time and money with Automarks in your shop!

AUTOMATIC FEEDS *and* FIXTURES MAY BE SUPPLIED...

SEND FOR BULLETIN ▶ **DEFIANCE MACHINE & TOOL CO.**
1922 S VANDEVENTER DEPT. PT ST LOUIS 10, MO

CIRCLE INFORM-A-GRAM KEY NO. 1763

You Can Use Full Working Tolerances

WITH
Em-re
DIAL INDICATORS

Patents Pending.

With "Em-re" Dial Indicators operators can always use their full working tolerances. These indicators are so accurate – and have such consistent repeatability – that there is never any need to make allowances for inherent inaccuracies or sluggishness. Tolerances read on the indicator itself can be exactly the same as those specified. "Em-re" .0001" indicators, for example, are accurate to within .00002". All "Em-re" Dial Indicators are fully jeweled – with the exclusive "Em-re" 100% shockproofing system that actually contributes to the greater accuracies obtained. Stocked in 29 models, 8 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". Also available for accurate indicator testing – the "Master" Dial Indicator Checker.

Write for Catalog E.

PETZ-EMERY INC.
PLEASANT VALLEY, NEW YORK

CIRCLE INFORM-A-GRAM KEY NO. 1762

SPEED UP PRODUCTION with these PALMGREN

ANGLE VISES · MACHINE VISES ROTARY TABLES

See how Palmgren vises, rotary tables, milling attachments and other machine tool accessories can speed up YOUR production and save time and money, too. Used in all industries, EVERYWHERE. 64 different models and types. Send for new catalog No. 203.

$39.95

No. 24B ANGLE VISE
4" jaw

Solve difficult Angle jobs on the production line – quick, accurate setups at any angle in such operations as drilling, milling, grinding. Also other jaw sizes: 1½", 2½", 3", 4", 6" and 8".

No. 60B MACHINE VISE **$99.95**
6" jaw

A precision vise, with or without swivel base, constructed for heavy-duty service in such jobs as milling, drilling, grinding, shaping and other operations requiring a rugged holding device. Also 40B – 4" jaw.

$79.95

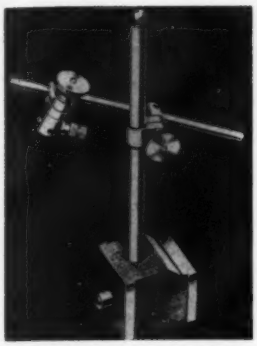
No. 83 ROTARY TABLE

Two cross feed slides and Rotary Feed converts your drill press for vertical milling. The No. 83 has an 8" diameter top with T slots ⅝" x 1" x 5/16" for keys or T bolts. Rotary dial is graduated in 3 minute intervals.

CHICAGO TOOL AND ENGINEERING CO.
8388 South Chicago Ave. • Chicago 17, Illinois

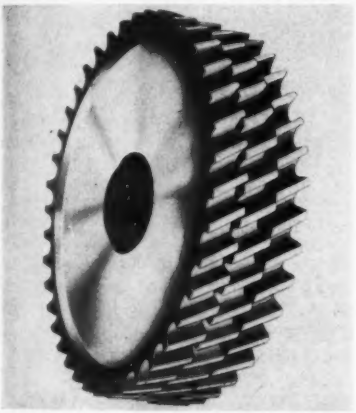
CIRCLE INFORM-A-GRAM KEY NO. 1764

The Magnetic Base Indicator Holder holds all types of dial indicators including rack and pinion models with lug type backs. No. 657AA is



furnished with a base which features a powerful permanent magnet and a large diameter pushbutton for turning the magnetic force on or off. The L. S. Starrett Co., Athol, Mass., or —
Circle Inform-A-Gram No. A29.

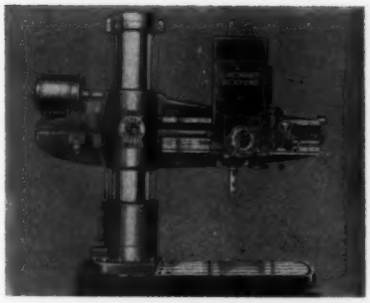
Difficult metal grinding and finishing operations are simplified with a versatile rubber contact wheel. The R-58 can shape itself to the contours of the object that is being ground. Time is reduced because it cuts much faster and hugs the contours. These



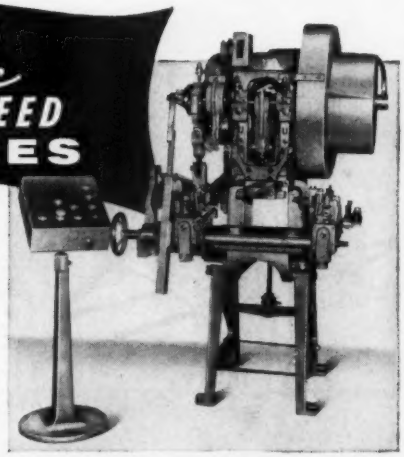
wheels, all 1" in width, are available in hardnesses or durometers, and can be combined for any width or hardness combination needed. Chicago Rubber Co., Inc., Waukegan, Ill., or —
Circle Inform-A-Gram No. A30.

For Joining and Overlay with the inert-gas consumable-electrode process use Ampco-trode 160 in spooled wire form. It develops tensile strengths up to 100,000 psi and hardnesses of 190-220 BHN and is recommended for joining the higher strength, harder aluminum bronzes. Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, or —
Circle Inform-A-Gram No. A31.

Radial Drilling Machines, offered with three heads, incorporate many advanced construction and operating features that permit faster, safer operation, and greater machining accuracy. These machines are available with 4' to 8' arm lengths, 36 spindle speeds up to 2300 rpm, and 18 lower feeds from 0.004" to 0.125". Cincinnati Bickford Div'n, Giddings & Lewis Machine Tool Co., Cincinnati, O., or —
Circle Inform-A-Gram No. A32.



PERKINS *Automatic* **HIGH SPEED PRESSES**



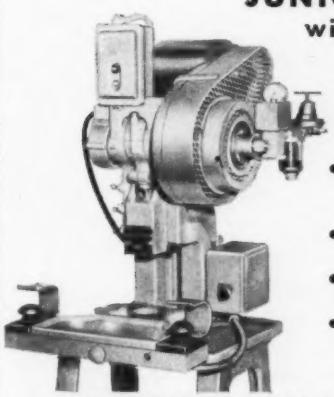
HIGH SPEED AUTOMATION

Here is a fast efficient machine equipped with AIR CLUTCH and accurate Double Roll Feed assuring top production! Feed has by-pass type Automatic Lifts, Scrap Chopper actuated from the crankshaft, Variable Speed Drive, Pedestal Type Press Controls and Variable Top Stop Control. This press is equipped with Automatic Lubrication and Bronze Gibs. Built in sizes of 10, 15, 20, 27, 35, 45, 60, 75 and 100 tons capacity.

Model 300B

JUNIOR HIGH SPEED PRESS
with Combination Air Clutch and Brake — 5 ton capacity

DEPENDABLE • VERSATILE • TOP PERFORMANCE



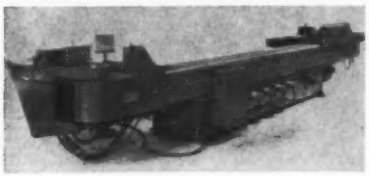
The latest advancement in small press design and performance, it gives:

- Single Tripping with speeds up to 600 rpm with dual hand buttons for safe, fast production.
- Continuous running—adjustable top stop control.
- Less maintenance—no clutch dogs or wheel inserts or springs to replace.
- Surprisingly low cost for complete unit.

PERKINS MACHINE COMPANY
Tel. HEMlock 6-7771
20 PERKINS STREET, WARREN, MASS., U.S.A.

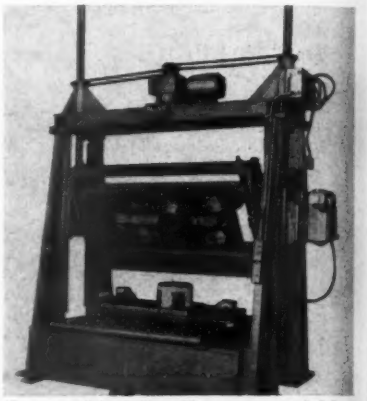
CIRCLE INFORM-A-GRAM KEY NO. 177

A Large Tube Bender handles tubing up to 6" OD and 20' in length. Model 76 operates at production rate while maintaining high precision. Maximum degree of bend is 180°, and maximum bend radius is 24". The entire pre-set bending cycle is performed automatically in one electrically controlled operation. Leonard Precision Products Co., 9200 Bolsa Ave., Santa Ana, Calif., or —
Circle Inform-A-Gram No. A33.

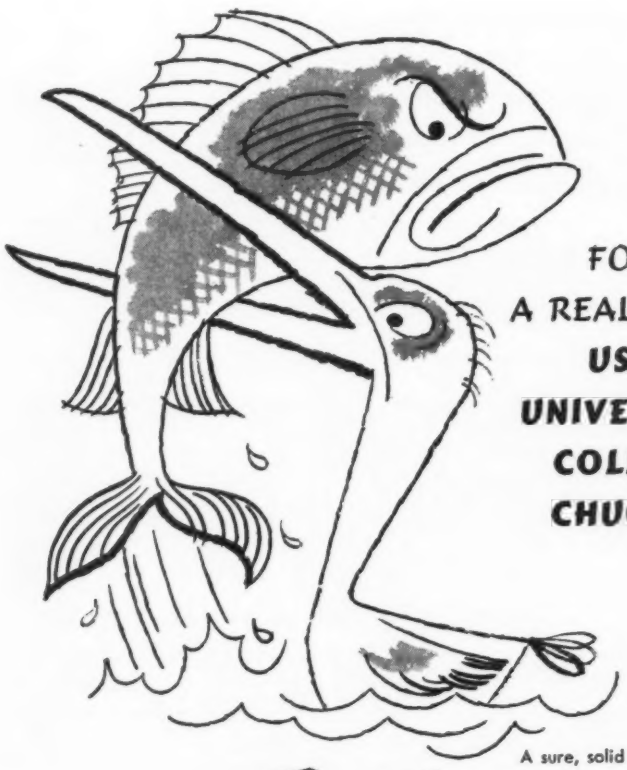


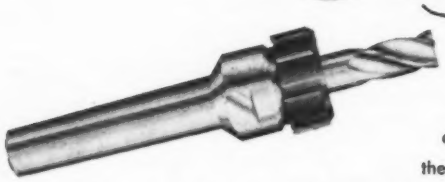
Inspect and Measure precision parts with a floor model micro projector. It features a vertical principle of design offering a horizontal stage onto which work of a flat nature is simply laid without aid of fixtures or holding devices. On an inclined screen the enlarged image is reproduced directly in front of the observer. The stage opening is 4" and round screen is 14" dia. George Scherr Co., 200 Lafayette St., New York 12, or —
Circle Inform-A-Gram No. A34.

A Die Handling Machine has been designed to simplify and speed assembly and disassembly of die sets, both large and small. Built in sizes to accommodate all sizes of die sets, the machine handles sets weighing up to 7,000 lbs and as large as 24" x 66". This machine can be used with dies of special shapes by modifying the slide frame. E. W. Bliss Co., Canton, O., or —
Circle Inform-A-Gram No. A35.



Squarehead Hydraulic Power Cylinders are made for service at 2000 psi, or 3000 psi in non-shock installations. The line comes in bores from 1½" through 12" and is available in all mountings, standardized for interchangeability. Anker-Holth Div'n, The Wellman Engineering Co., 2723 Connor St., Port Huron, Mich., or —
Circle Inform-A-Gram No. A36.





A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. Tools can't slip and tool shanks don't get scored. Even tool stubs and broken drills can be used successfully. Sizes range from 1/16" to 1½", with shanks to fit any machine. Simplified design results in low chuck cost to you. Write today for new "complete line" catalog.

199

UNIVERSAL ENGINEERING CO. FRANKENMUTH 8, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 178

WALLS TU-WAY BELT SANDER

USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

complete with cord, plug, switch ready to use **$89.95**

Illustrated Literature on Request

A few desirable distributor territories still available.

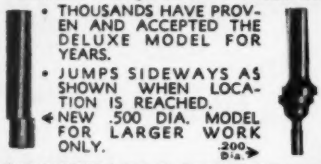
WALLS SALES CORPORATION
333 Nassau Avenue Brooklyn 22, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1791

.0003 HOLE LOCATION IN 1 MINUTE

EDGE FINDERS

$2.50 NEW POSTPAID except C.O.D. **$10.00 DELUXE**



- THOUSANDS HAVE PROVEN AND ACCEPTED THE DELUXE MODEL FOR YEARS.
- JUMPS SIDEWAYS AS SHOWN WHEN LOCATION IS REACHED.
- NEW .500 DIA. MODEL FOR LARGER WORK ONLY. .200 Dia.

ADJUSTABLE VISE STOP

$2.95

HUNDREDS OF PIECES TO A .0003 TOLERANCE WITH THIS HARDENED VISE STOP THAT IS ADJUSTABLE IN ALL DIRECTIONS. ATTACH TO VISE WITH ONE ¼—20 TAPED HOLE.

Dealer Inquiries Invited

GLOVER MFG. CO.
422 Park Ave. Meadville, Penna.

CIRCLE INFORM-A-GRAM KEY NO. 1792

PREPARES COIL STOCK FOR PRESS

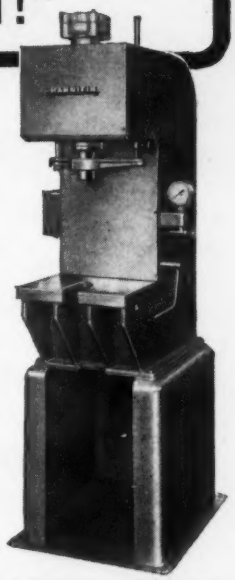
New Low Cost
LIGHT-DUTY OILER-STRAIGHTENER
$95.00
Handles stock up to 3" wide, 1/16" (app.) thick

Write for details

JACO DEVICES, INC.
96 High St., Hingham, Mass

CIRCLE INFORM-A-GRAM KEY NO. 1793

"BEST $1530 WE EVER SPENT!"



That's the price of this 5-Ton HANNIFIN Press*

A lot of production men have made such comments about this versatile little hydraulic press.

They like the way you can adjust it to the exact force you need for each job, all the way from 1 ton to 5 tons. The backstroke is adjustable, too, so the ram just clears the work on any job. Fast-acting controls. Prompt delivery from stock.

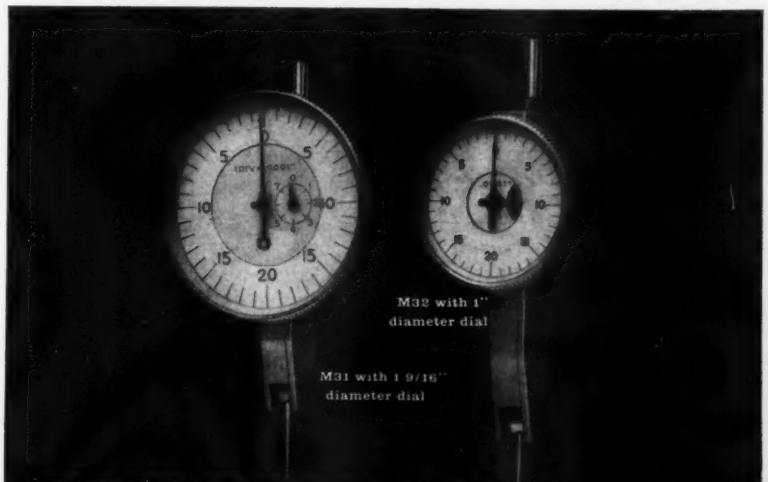
WRITE. Complete information and prices on the Hannifin line of 1- to 10-ton Hydraulic Presses will be sent on request.

*Price complete with motor and starter F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.

HANNIFIN

HANNIFIN COMPANY, 563 S. WOLF ROAD, DES PLAINES, ILLINOIS

CIRCLE INFORM-A-GRAM KEY NO. 1794



RUGGED ALINA DIAL TEST INDICATORS

built-in ball bearings

for greater sensitivity—reduced pressure—improved accuracy

- Jeweled • Shock Proof • Range .032" • Graduated .0001"
- Reading 0-20-0 • Fully reversible contact point

Available with a wide variety of rectangular or round shanks.

The instruments shown here are part of a complete line of precision DIAL TEST INDICATORS of all types — Write for brochure!

ALINA CORPORATION
122 East Second St., Mineola, L.I., N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 1795

ARROW
JET MIST Generator

Utilizes machine tool SUMP and SUMP PUMP

NO—Pressurized Coolant Tank

NO—Special Spray Heads

NO—Pressure Regulators

NO—Control Panel NO—Gauges

MODEL M-100 JET MIST GENERATOR now provides for an inexpensive, fast set-up method for cooler cutting at higher speeds with longer tool life at lower costs.

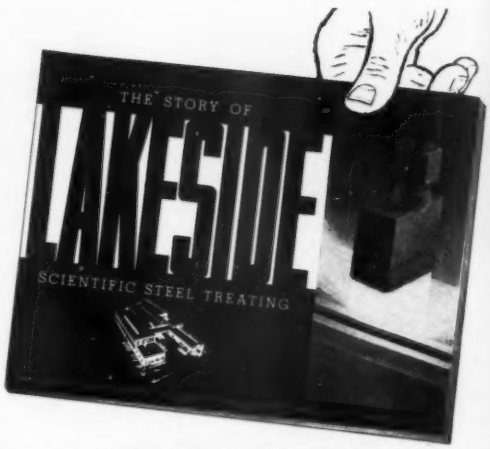
Simply and easily mounted to all types of machine tools and metal working machinery.

Send for Bulletin MG-1056.

ARROW TOOLS, INC.

1928 S. KOSTNER AVE. • CHICAGO 23, ILL.

CIRCLE INFORM-A-GRAM KEY NO. 1801



Want to KNOW MORE about Steel Treating

Here's the complete Lakeside story — all in one easy-to-read brochure! Big pictures showing how we perform every scientific steel treating service. Short but explicit descriptions of our many services and how you can best use them. It's the "most read" story of steel treating in industry today — Be sure you get your copy — Write or call NOW!

Our Services:

Flame Hardening*, Bar Stock Treating and Straightening (mill lengths and sizes), Carbonitriding, Heat Treating, Annealing, Electronic Induction Hardening, Stress Relieving, Normalizing, Carburizing — Pack, Gas or Liquid, Nitriding*, Speed Nitriding, Aerocasing, Chapmanizing*, Cyaniding — Gas or Liquid, Sand Blasting, Laboratory Physical Testing.

*LICENSED PROCESS

THE *Lakeside Steel Improvement Co.*

5418 LAKESIDE AVE., CLEVELAND 14, OHIO HENDERSON 1-9100

CIRCLE INFORM-A-GRAM KEY NO. 1802

CY-CO-TROL
CUTTER GUARDS

safety maintenance of multiple tooth cutters

← **PROTECTS OPERATORS HANDS**

← **PROTECTS CUTTER BLADES**

← **PROTECTS FINISHED PARTS OF MACHINE**

← **ELIMINATES** costly applications of hot-dip plastic material directly to your cutters.

Cutter Guard holds to cutter by a spring pressure band to which segments are fastened and CUTTER GUARD UNIT IS COMPLETELY COATED WITH A TOUGH PLASTISOL MATERIAL which gives ultimate protection to cutter teeth. CY-CO-TROL CUTTER GUARDS are available for any size cutter, from 4" in diameter to 20" in diameter. Guards for cutters of larger diameters, guards for cut-off saws, or special shaped cutters can be supplied on special order.

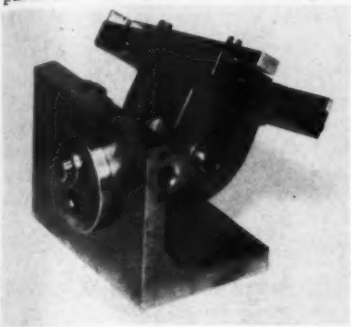
Write for Catalog

ROYAL design and manufacturing, Inc.

4133 E. TEN MILE RD., CENTER LINE, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1803

A Multi-Angle Grinding Fixture is easily adjustable, and the adjustment is provided to take out back lash in the worm and gear. All mechanical parts are sealed, and the tool may be

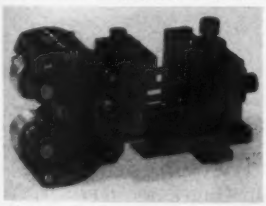


used horizontally or vertically. The fixture comes in three sizes; 2½" x 1¾", 3" x 3", and 4½" x 3". F. E. Smith, Toolmaker, 840 S. Main St., Attleboro, Mass., or —
Circle Inform-A-Gram No. A37.

Inserted Blade Interlocking Side Milling Centers for channeling of aluminum and magnesium alloys have been introduced by Goddard & Goddard Co., 12280 Burt Rd., Detroit 23. The cutters are easily expanded

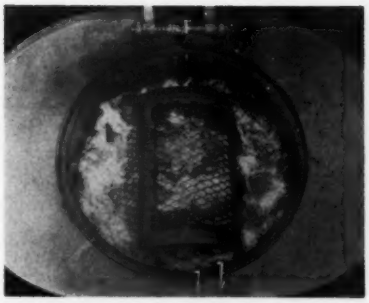
to meet slotting width variations. Total adjustment is 3/16" to 5/16" depending on the width of the cutter body.
Circle Inform-A-Gram No. A38.

A Thread Rolling Attachment is used with small automatic screw machines. Model B8 has independent adjustable arms to accommodate a range of work diameters within its



capacity, and also provides a means for accurate sizing of the work. Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass., or —
Circle Inform-A-Gram No. A39.

A Degreaser degreases oil, grease, sludge, cosmoline, while cleaning out metal cuttings, boring, and drillings in one mechanical operation. The cleaner creates a whirlpool action which quickly removes and traps dirt and accumulations in a matter of minutes. The unit comes in 75- to 2000-gal units able to accommodate parts of almost any size and shape. Argosy Industries, Inc., 67 May Court, Chagrin Falls, O., or
Circle Inform-A-Gram No. A40.



T-J Reamers
have throw-away heads, too!

New Exclusive Design Cuts Replacement Costs More Than Half!

Exclusive in design . . . the New-type T-J Reamers cut your replacement costs *more than half!* Only the quickly installed *head* to replace, after buying original shank. Wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments are available with right or left hand spiral flutes for thru or blind hole reaming.

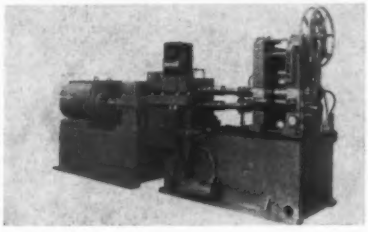
Tapered hole in head insures concentricity and *new* thread design assures a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking due to cutting portion wearing undersize and creating negative relief. Backed by T-J's 40 years of know-how as one of the largest manufacturers of die sinking milling cutters. Write to Tomkins-Johnson Co., 617 North Mechanic Street, Jackson, Michigan for T-J Catalog #153-1.

T-J TOMKINS-JOHNSON

TOMKINS-JOHNSON CO., Jackson, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 181

Roll Materials requiring heated rolls with a two-high four-high mill. This rolling mill has a potential use in the bonding of bimetal strip. An example would be the bonding of steel and aluminum used in main



bearings and connecting rod bearings of gasoline and diesel engines. Model 4-055 is equipped with 5¼" x 8" back up rolls and 1⅝" x 8" work rolls. The Fenn Mfg. Co., Fenn Rd., Newington, Conn., or —
Circle Inform-A-Gram No. A41.

Control Clamping Pressure on jigs and fixtures, assemblies, machinery, etc., where ordinary torque thumb screws would require machining or other customizing to adapt to existing setups, with an adjustable torque handle. End pressure is easily ad-

justable from 15 lbs to 200 lbs. The tapped hole is available in three sizes: 5/16-18; 3/8-16; and 1/2-13. Vlier Engineering, Inc., 8900 Santa Monica Blvd., Los Angeles 46, or —
Circle Inform-A-Gram No. A42.

Level and Set Up Machine Tools with magnesium straight edges which weigh less than ¼ the weight of semi-steel units of similar size. These units are available in all sizes

from 3' to 14' in length. Surface accuracies, within 0.0002" of an inch in 6', are available. The Challenge Machinery Co., Grand Haven, Mich., or—**Circle Inform-A-Gram No. A43.**

A High-Capacity demand-feed storage unit for parts that can roll, in which the parts are fed by a belt although resting and rolling on a metal guide track, is available. The unit is designed for use in automated processing lines. Gear-O-Mation Div'n, Michigan Tool Co., 7173 E. McNichols Rd., Detroit 12, or —
Circle Inform-A-Gram No. A44.

A Vibration Analyzer and Portable Balancer measures vibration, pinpoints the cause, and corrects it in place, without costly dismantling of machinery. The IRD portable Model 600 provides instrumentation to

measure the amplitude or velocity, the frequency and the phase of the vibration, etc. International Research & Development Corp., 797 Thomas Lane, Columbus, O., or —
Circle Inform-A-Gram No. A45.

ARE YOU USING- HOVIS UNIVERSAL Master COMPOUND DIES

to Produce WASHERS and SMALL STAMPINGS from all Types of Materials the ECONOMICAL WAY?

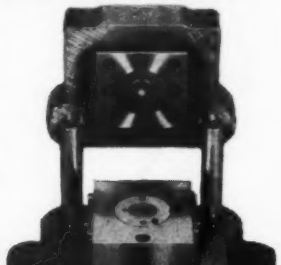
SAVES

DESIGNING COST
TIME • LABOR
MATERIALS
STORAGE SPACE

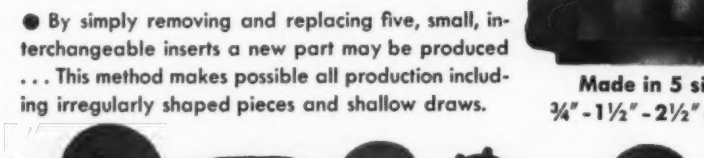
The "MODERN METHOD" adopted by MANUFACTURERS NATIONALLY

NO NEED TO MAKE A NEW DIE FOR EVERY STAMPED PART

● By simply removing and replacing five, small, interchangeable inserts a new part may be produced . . . This method makes possible all production including irregularly shaped pieces and shallow draws.



Made in 5 sizes:
¾" - 1½" - 2½" - 4" - 6"



Specialists in designing and manufacturing MULTI-DIES as well as supplying COMPLETE TOOLING FOR ALL SIZES OF NUT FORMERS

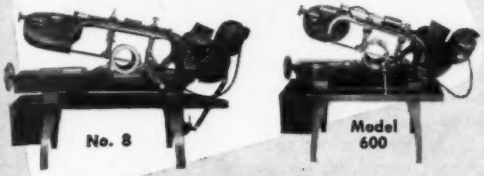
Write for Literature

HOVIS SCREWLOCK COMPANY

8100 E. NINE MILE ROAD • BOX G • VAN DYKE, MICHIGAN
Phone: Slocum 7-4800 Suburb of Detroit

CIRCLE INFORM-A-GRAM KEY NO. 182

Simple Design... Rugged Construction



WELLS HORIZONTAL METAL CUTTING BAND SAWS

The simple design and rugged construction of every "Wellsaw" didn't just happen. We planned it that way! Over 30 years of specialized band saw experience and know-how is your assurance of the quality and service with each machine produced by Wells Manufacturing Corporation.

There is a Wells Saw of the right style, capacity and speed to do a better, more economical job for you. Wells Saws will deliver long, dependable service. Operating and maintenance costs are very low. See your Wells Distributor.

Wellsaws — Wells

The Pioneers of Horizontal

METAL CUTTING BAND SAWS

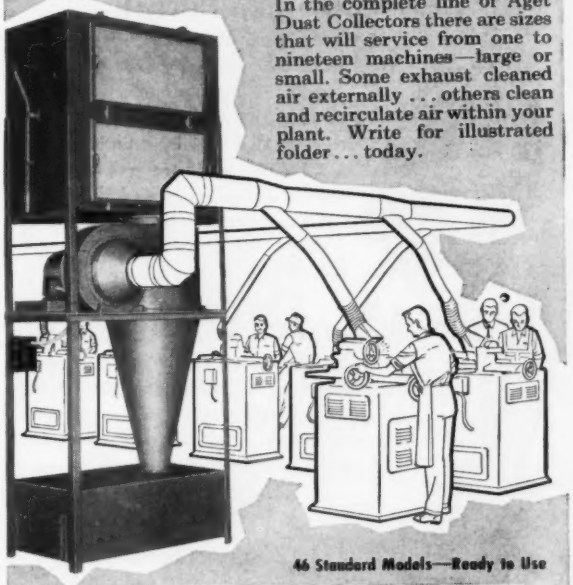
WELLS MANUFACTURING CORPORATION
1940 Cedar Street
THREE RIVERS, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 1831

just **ONE** DUSTKOP STOPS DUST

heavy duty unit services up to 19 MACHINES

In the complete line of Aget Dust Collectors there are sizes that will service from one to nineteen machines—large or small. Some exhaust cleaned air externally . . . others clean and recirculate air within your plant. Write for illustrated folder . . . today.



46 Standard Models—Ready to Use

AGET manufacturing company
1394 Church Street • Adrian, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 1833

Precision Tapping

by hand or machine with

DAHLSTROM TAP GUIDE

saves countless hours by preventing broken taps.

A low-cost Dahlstrom Tap Guide provides the accuracy and close tolerances of larger machines costing many times as much. Tap breakage, a major expense in many shops, is virtually eliminated with a Dahlstrom Tap Guide because metal material is always held straight and square. Light enough for portability, yet it can be bolted to wall or post for permanent installation.

Machine Tapping

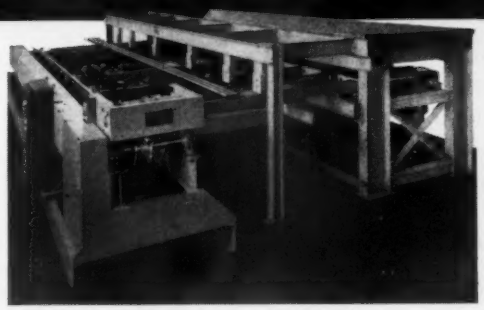
The spindle top is centerbored to fit the tail stock of a lathe. Simply pull out for lathe use. The same spindle can also be used as a tap extension for reaching hard-to-get-at places. Tap Guide is furnished with nine adaptor sizes: 8-32; 10-24; 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", and 3/4". *Write for bulletin.*

$59.50 F. O. B. Factory

BRANCH MFG. CO.
16 Olson Drive, North Branch, Minn.

CIRCLE INFORM-A-GRAM KEY NO. 1832

HOPPER FEED LONG ROUND BARS OR TUBES FROM HOPPER TO SHEAR AUTOMATICALLY



10,000 lb. bundles are dropped into hopper, shown at right. Metering transfer table, in center, transfers the bars to the "V" roll conveyor, shown at left, through metering hands and escapement fingers, which release one bar at a time upon receipt of a signal from the "V" roll conveyor, thus the powered "V" roll conveyor feeds the shears automatically and continuously at its maximum capacity.

"Automation Specialists—Since 1923"

SPURGEON CO.
23501 HOOVER ROAD
VAN DYKE, MICHIGAN

Write for Catalog

CIRCLE INFORM-A-GRAM KEY NO. 1834

2 new Clark tools for HOLE-MAKING, SPOT-FACING, COUNTERBORING!

Clark HOLE-MILL—A high-production tool for precision, fixed-diameter holes! Removable head of M3-type high-speed steel cuts all materials, including alloy steels. Easy, accurate starts on crowned, irregular or webbed surfaces with piloted action. Makes single passes through thick stock; utilizes power feeds. Standard sizes: 1" to 4" diameter. Other sizes on order!

Clark ADJUSTABLE SPOT-FACER AND COUNTERBORE Heavy cuts, no chatter with unique shearing principle! Expandable M3-type high-speed steel blades quickly set to tolerance, easily reground. Piloted action. Excellent performance in Mills, Radials, Drills, Turret Lathes. Standard sizes: 1" to 4" diameter, others on order!

Write for full data, recommendations and prices!

Robert H. Clark Company
9330 Santa Monica Blvd., Beverly Hills, California

CIRCLE INFORM-A-GRAM KEY NO. 1841

DIE DESIGNING AND ESTIMATING

Fourth Edition

368 pages, 26 chapters, over 400 illustrations, charts and graphs. 165 Practical Points in Die Design and Construction. Comprehensively indexed.

Written expressly for Die Designers, Die Engineers, Tool and Die Makers, Owners and Managers of Tool and Die Shops and Depts., Students, Apprentices and valuable, too, as a reference and refresher for the die experts who are more than qualified to write a comparable text.

Price, only $7.50 per copy.

Immediate shipment.

HUEBNER PUBLICATIONS, INC. 12-57
1971 Lee Road, Cleveland 18, Ohio

Gentlemen: please ship immediately_____copy (copies) of DIE DESIGNING AND ESTIMATING, Fourth Edition at $7.50* per copy.

COMPANY_____
BY_____
ADDRESS_____
CITY_____ZONE_____State_____
TP 11

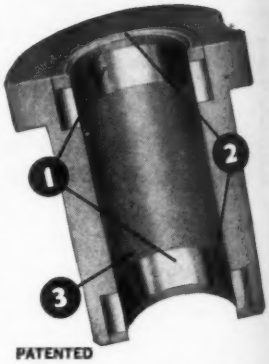
Open account shipments on purchase orders or rated companies. Otherwise, check must accompany order. No C.O.D.'s please. *Ohio customers add 3% sales tax.

MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation!*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 41.



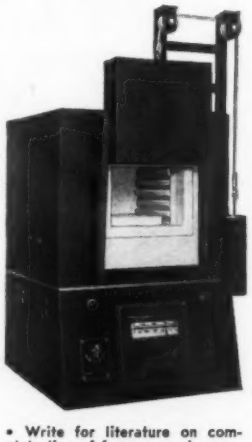
PATENTED

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 1842



Designed for TOOL ROOM EFFICIENCY

HUPPERT *Heat Treating* FURNACES

Range: 300° F. to 2000° F.

Years of satisfactory operation in tool, die and machine shops, as well as laboratories have proven these furnaces to be ideal for production work. Huppert special features include High Temperature, Heavy Duty Kanthal elements—Multi-insulation—counter-weighted and tight self-sealing door. Pilot lights indicate furnace operation. All connections factory installed, shipped ready for operation.

• Write for literature on complete line of furnaces and ovens. Ask for Hints on Heat Treating.

Model No.	Inside Dimensions			KW	Prices 220 volt single phase	
	Wide	High	Deep		With Huppert input controller	with electronic temperature controller
869	8"	6"	9"	4	$296.00	$480.00
11	8"	6"	12"	4	306.00	518.00
12*	8"	8"	12"	6	382.00	590.00
12A*	8"	8"	18"	9	490.00	698.00

*For 2300°F. add $95.00 to No. 12 and $105.00 to No. 12A. No. 12A can be furnished for 3 phase at no additional cost. For floor model add $52.00 to above prices.

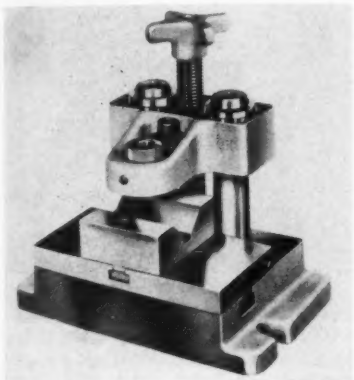
K. H. HUPPERT CO.
6820 Cottage Grove Avenue, Chicago 37, Illinois
Manufacturers of Electric Furnaces and Ovens

CIRCLE INFORM-A-GRAM KEY NO. 1843

An Air-Powered Screw Driver and Nut Setter series has been designed to increase production. They have a complete speed and torque range

from high speed, low torque to high torque, low speed. This series is light in weight and has a body diameter of only 1½". Gardner-Denver Co., Quincy, Ill., or —
Circle Inform-A-Gram No. A46.

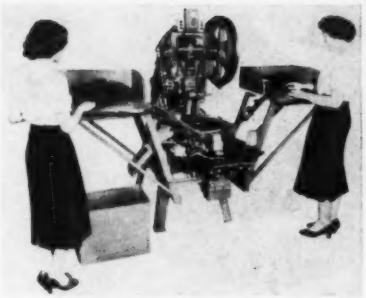
Precision Center or Off Center Drilling, tapping, and reaming is done with an adjustable V-block drill jig designed to cut costs. It



accommodates drill bushings of diameter sizes from 0.0135" to 0.5625" V-blocks, 9/16" and 1½" in V-widths, hand handles stock sizes from ¼" through 2" OD. Rockford Engineered Products, Inc., 2324 23rd Ave., Rockford, Ill., or —
Circle Inform-A-Gram No. A47.

A Hi-Torque Bolt is now available in a wide variety of materials and full range of sizes. It is used in applications where strength at extremely high temperatures, high loads, and pressures must be maintained. High fatigue life, close recess tolerance control without the attandant weight penalty, and a recess which may be generated into any steel, alloy, or special material are among the advantages. Hi-Shear Rivet Tool Co., 2600 W. 247th St., Torrance, Calif., or —
Circle Inform-A-Gram No. A48.

A Multi-Color Hot Stamping Press features a front extension on which a large dial, automatic feed, and electronic controls have been incorporated. An arrangement has been added to the head of the press to allow two or three colors to be hot stamped at one time. Model 2AH has an operating speed of 130 for 2 color pcs/min at 100% loading. The Acromark Co., 439 Morrell St., Elizabeth 4, N. J., or —
Circle Inform-A-Gram No. A49.



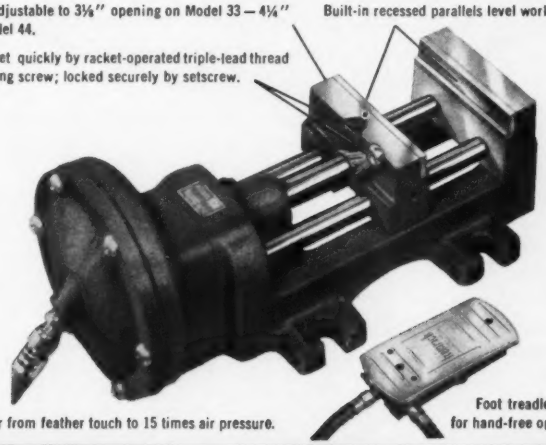
NOW heinrich AIR VISES

IN TWO SIZES—3" or 4" JAW WIDTHS
FOR HIGH-SPEED PRODUCTION

Jaws adjustable to 3⅛" opening on Model 33 — 4¼" on Model 44.

Jaws set quickly by racket-operated triple-lead thread adjusting screw; locked securely by setscrew.

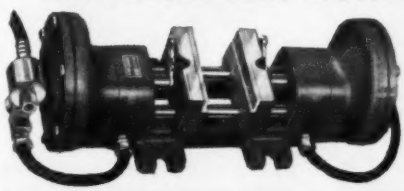
Built-in recessed parallels level work.



Holding power from feather touch to 15 times air pressure.

Foot treadle control for hand-free operation.

HEINRICH SELF-CENTERING AIR VISE



Movement of jaws synchronized within a tolerance of .001" by gear and rack. 4" wide jaws adjustable to 4⅛" opening, travel ⅜" each jaw; total ¾".

HEINRICH AIR CLAMP

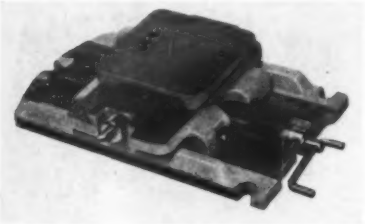
Eliminates bothersome hand clamping. Piston rod setting adjustable to 3⅛". Maximum travel ⅜". Height 6⅛", width 5¾".

WRITE FOR FREE CATALOG

heinrich TOOLS, INC.
DEPT. 137-M, RACINE, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 185

A Feed Table provides feeds and slides for multiple combinations of metalworking. The tool is ideal for high production, automation setups.



Four feed table sizes are available with longitudinal feeds varying from 8½" on the smallest to 42½" on the largest. The Dumore Co., 1300 17th St., Racine, Wis., or —

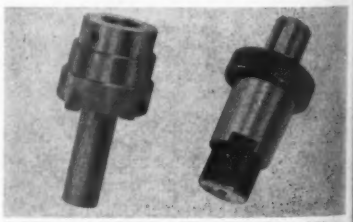
A Hand Screw Machine is designed to cut costs of manufacturers with short production runs. The machine features a bed turret with six stations for up to six operations. The turret is moved quickly from one operation to the next with a simple turn of the pilot wheel, and the

workpiece is chucked in a fraction of a second by a touch on a conveniently located lever. Delta Power Tool Div'n, Rockwell Mfg. Co., 475 N. Lexington Ave., Pittsburgh 8, or —
Circle Inform-A-Gram No. A51.

Large Black Granite Angle Plates have been announced by Rahn Granite Surface Plate Co., 638 N. Western Ave., Dayton 7, O. Illustrated is a matched pair having bases 18" x 18"

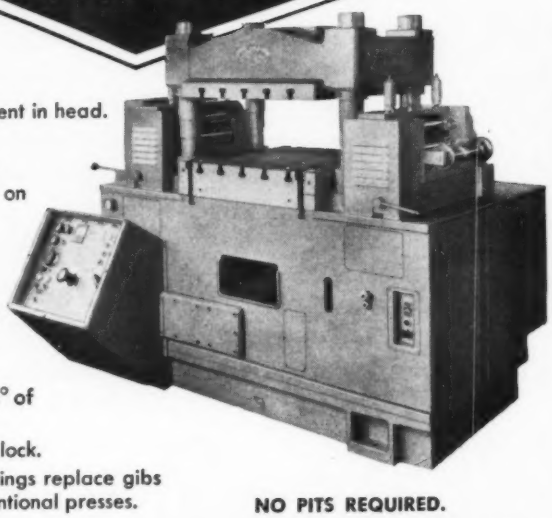
with 30" heights and weighing one ton. The tolerance for squareness is 0.00012" in the 30" height. This averages only 4 millionths of an inch per inch of height, which is less than 1 sec or arc.
Circle Inform-A-Gram No. A52.

Collet Chucks are offered in a line by Precision Processing Co., 3269 Casitas, Los Angeles. The Precore internal collet chuck line features interchangeable collets ranging from



0.500" to 1.250". The PreCor Align-A-Chuck provides corrections for misaligned turrets as well as angular, vertical, horizontal, and radial inaccuracies found in tailstocks, arbors, and spindles.
Circle Inform-A-Gram No. A53.

ALPHA
TWO POINT
BACK GEAR UNDER DRIVE
PRODUCTION PRESSES
Capacity of 75 to 200 tons



Outstanding Features

- Shut height adjustment in head.
- Center drive type herringbone gears.
- Scrap cutter action on up-stroke of press.
- Cam adjustments for brake & roll feeds.
- Micro adjustment of metal travel.
- Timing of scrap cutter from 0° to 45° of up-stroke of press.
- Positive shut height lock.
- Bronze sleeve bearings replace gibs as utilized on conventional presses.

These precision presses are basically precision operating, high-speed automatic stamping presses. They have built-in precision in the same terms as the word "precision" is associated with modern machine tools. This inherent quality has been designed into these presses from the ground up.

NO PITS REQUIRED.

UNBALANCED DIES can be handled without distortion.

FAST, ACCURATE, WILL GIVE LONG TROUBLE-FREE SERVICE and LONG DIE LIFE.

PRESSES UP TO 300 TON CAPACITY, AVAILABLE TO CUSTOMER PARTICULAR REQUIREMENTS.

Write for Catalog

ALPHA PRESS & MACHINE, INC.
9281 Freeland Avenue • Detroit 28, Michigan

CIRCLE INFORM-A-GRAM KEY NO. 186

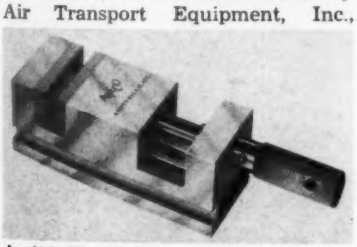
A Machine Tool Clamp Assembly has been announced by Hi-Lo Products Co., 8817 Lyndon Ave., Detroit 38. They have clamping ranges of ⅞" to 2¼" and 2⅜" to 4⅞". Models

are available with "T" or stud bolt subassemblies which are interchangeable, and have the patented ¼ turn serration lock feature that provides quick, safe, and accurate adjustments.
Circle Inform-A-Gram No. A54.

An Extension Unloader Unit has added new utility to the Rapistan flow rack. The device makes it possible to use the flow rack for point-of-use storage of goods that are too

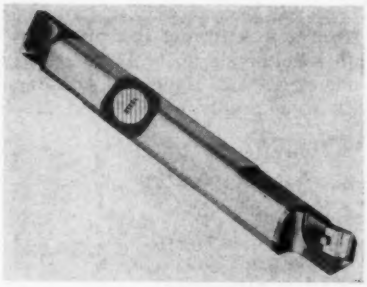
heavy for manual handling. It allows goods to flow far enough out of the rack to allow use of an overhead hoist. The Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich., or —
Circle Inform-A-Gram No. A55.

A Toolmakers Vise, precision ground on all external surfaces to an accuracy of 0.0004" per inch, not cumulative, has been introduced by Air Transport Equipment, Inc.,

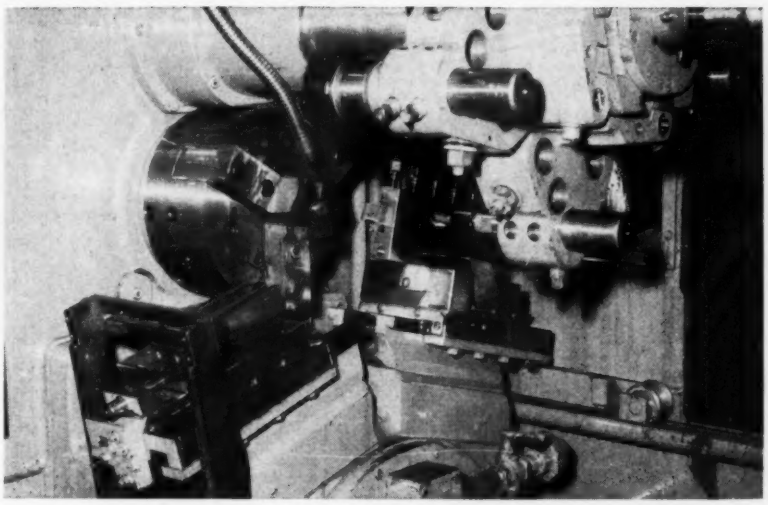


Amityville, N. Y. A groove all around the base of the vise provides means of clamping it to machine tables, etc. Three models are available.
Circle Inform-A-Gram No. A56.

A Double-End Boring Bar encased with Kennametal hard tungsten carbide reduces chatter and reduces the cost of precision boring. This bar is being made in a range of sizes for machine shop use. Kendex type clamping mechanisms are recessed in each end of the bar to hold the chip-breaker, insert, and seat. Triangular and square inserts are used on the ends of the boring bar. Kennametal Inc., Latrobe, Pa., or —
Circle Inform-A-Gram No. A57.



WARNER & SWASEY with *Buck* AJUST-TRU® POWER CHUCK
"Repeats to .0005*, reduces scrap"



If you use automatics this report from A. F. Gabriel, V-P Eng. & Prod., Acme Industrial Co., Chicago, should be of value.

"We have set up your 10" air operated chucks as standard equipment on our machines . . . many parts require repeat chuckings . . . most have extremely close concentricity requirements. With Buck chucks we can repeat to tolerances of .0005* and less . . . your chuck has allowed us to improve quality and has reduced our scrap."

It pays to chuck with Buck! Send for catalog — see why.

** Although Acme does better, the guaranteed precision of Buck Power Chucks is .001"*

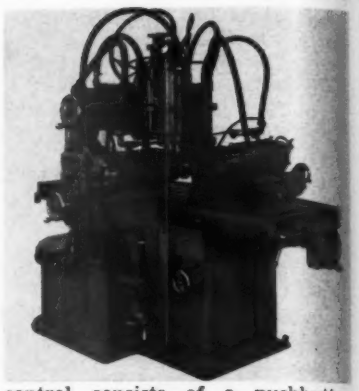
BUCK TOOL COMPANY

1218 SCHIPPERS LANE • KALAMAZOO, MICH.

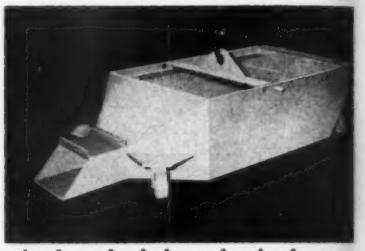
CIRCLE INFORM-A-GRAM KEY NO. 187

An Air Hammer will seal any lock seam a lock former can produce in all sheetmetals up to 18 ga steel in one swift pass. Model AR-4-H Ram-Ex weighs only 4½ lbs and has a hand size trigger. A feature is the full control or blow forces at the tool by simply twisting the impact control behind the trigger. The proper force for a specific gauge is quickly set. E. V. Nielsen Inc., 129 Broad St., Stamford, Conn., or —
Circle Inform-A-Gram No. A58.

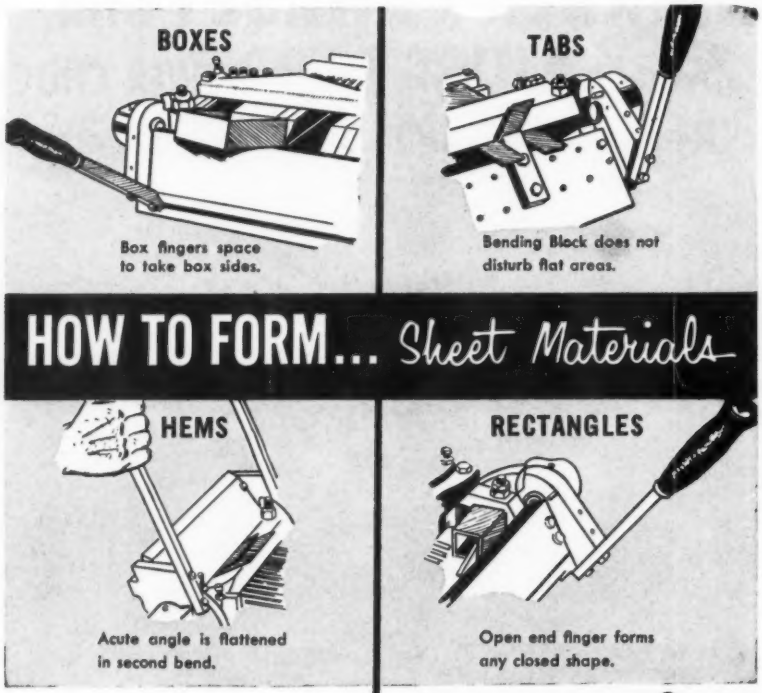
The Tri-Way Milling Machine can mill up to 3 sides at one time, of any part square or rectangular in cross section. The A-242S machine has a maximum table working area of 27" x 42" x 60" or 72". The electrical control consists of a pushbutton panel mounted on the machine with magnetic starters and overload and undervoltage protection mounted in the control panel. A bulletin on the machine is available from Onsrud Machine Works, Inc., 7720 N. Lehigh Ave., Niles, Ill., or —
Circle Inform-A-Gram No. A59.



Three Hopper Pans to speed loading, unloading, storage, and transfer of tumble-finishing media are available from Rampe Mfg. Co., 14915 Woodworth Ave., Cleveland 10. The welded steel pans have ball-bearing wheels and a balanced yoke for easy transport and lifting. Standard sizes include 1 cu ft hand size pan, and 4 cut ft and 8 cut ft sizes for handling with crane or hoist hook.
Circle Inform-A-Gram No. A60.



Flange Racks and Grabs have been designed for installations where crane capacity is adequate for lifting of multiple loads of bar stock, sheets, tubing, etc. Because of the positive-nesting feature these racks can be stacked in tiers up to 8 high, storage capacity can be increased as much as 300%. Jarke Mfg. Co., 5407 N. Broadway, Chicago 40, or —
Circle Inform-A-Gram No. A61.


BOXES
Box fingers space to take box sides.
TABS
Bending Block does not disturb flat areas.
HOW TO FORM... Sheet Materials
HEMS
Acute angle is flattened in second bend.
RECTANGLES
Open end finger forms any closed shape.

with a
DI-ACRO BRAKE

The Di-Acro Brake is a six-in-one precision metal working machine simply tooled for a variety of jobs. Ten models in 6", 12", 18" and 24" widths handle up to 16 gauge mild sheet steel.

Consult the yellow pages of your phone book for the name of your nearest Di-Acro distributor or write for 16 page "Handy Guide" to Di-Acro Brakes.

di-acro PRECISION METALWORKING MACHINES
pronounced die-ack-ro

O'NEIL-IRWIN MANUFACTURING CO.
315 Eighth Avenue • Lake City, Minnesota

CIRCLE INFORM-A-GRAM KEY NO. 71

MOLD COST FOR THIS PART?

Actual Size

Nothing!

Performance: SUPERIOR

Price: CHEAPER

SAVINGS effected by converting from bronze to Nylon paid for the mold of this spherical bushing.

Formerly it was a 5-step machining operation at a unit cost of .575 cents. It is now made in one operation. In 1000 lots each part costs .255 cents. *Savings on the initial order paid for the mold.*

LET US QUOTE ON YOUR SHORT-RUN PLASTIC MOLDINGS. WE WILL SUBMIT QUOTATIONS WITHOUT OBLIGATION.

DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 1891

BOOST POWER PRESS PRODUCTION!

These Components Reduce Material Handling Costs, Save Floor Space and Permit Continuous Flow Operation.

AIR OPERATED SLIDE FEEDS

MECHANICAL SLIDE FEEDS

SMALL PARTS STRAIGHTENERS

SCRAP CHOPPERS

STOCK CRADLE AND STRAIGHTENERS

PORTABLE STOCK STRAIGHTENERS

WRITE FOR INFORMATION ON ANY OF THESE PRODUCTS TO

COOPER WEYMOUTH, INC.

600 HONEYSPOT ROAD • STRATFORD, CONN.

CIRCLE INFORM-A-GRAM KEY NO. 1893

500 lb. Lifter- NOW $210 f. o. b. Chicago

Pays for itself over and over again in time saved and by avoiding lifting injuries in moving dies, machine parts and stacking. Can be used as adjustable height work table. Rugged, simple construction, with few moving parts, has high safety overload factor. Automatic clutch holds load at any height.

Specifications: platform 24" x 24", lifting height 4' 6". Overall height 6' 0". Width 24". Foot operated floor lock.

SHOPLIFTER

This sturdy, general purpose lifter makes it easy for one man to handle lifting jobs quickly and with complete safety.

Order Today— Free Trial

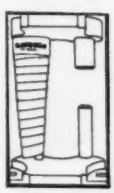
specify 10 day free trial, with full credit return privilege. 1000 lb. and 2000 lb. Shoplifters also available.

ECONOMY ENGINEERING 4509 W. LAKE ST. Chicago 24 Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1892

ON Dies EQUIPPED WITH

ELASTICONE GUIDE PIN COVERS



Day after day, year after year, manufacturers of ALL products are discovering how Elasticone Guide Pin Covers can work for them . . cutting die costs by eliminating the need for spare dies. Inexpensive Elasticones close the gap between pins and bushings, protecting dies against breakage . . protecting workers against injuries. Available in sizes to fit most pins and bushings.

Write for complete literature and new Technical Bulletin 53

CENTRAL Safety Equipment Co.

6603 MARSDEN St. PHILADELPHIA 35, PA.

CIRCLE INFORM-A-GRAM KEY NO. 1894

HERE'S WHY

it's easy to know and use

Anocut®

ELECTROLYTIC GRINDING!

Formed just over two years ago, Anocut Engineering Company already has a complete national network of experienced sales and service engineers and distributors. All Anocut personnel stand ready and able to assist you in the proper selection, installation and operation of Anocut Electrolytic Grinding Equipment on conventional grinders.

You can find out more about the singular benefits possible with Anocut Electrolytic Grinding by sending the coupon below for descriptive literature—or by asking for the name and address of the Anocut Service Engineer nearest you.

Use This Coupon!

ANOCUT
Engineering Company
631 WEST WASHINGTON
CHICAGO 6, ILLINOIS
The Electronic "plus" in Grinding

Send information on Electrolytic Grinding of:

( ) Carbide tools and cutters
( ) Hardened steels
( ) Honeycomb
( ) High temperature alloys
( ) Other
( ) Have a Representative Call

Name _____

Company Address _____

City _____ State _____

CIRCLE INFORM-A-GRAM KEY NO. 1901

Up to 3400 Bars End-Heated Per Hour

with G.A.S. ROTO-FLAME FURNACE

The Choice of Most Prominent Bolt Manufacturers

Because—

Production is Increased — thru faster heating — automatic feeding of work — and, elimination of rejects.

Operating Costs are Reduced — thru reduced labor — increased die life — conservation of floor space — and, fast heat-up periods.

Product is Improved — thru elimination of objectionable scale — improved plasticity of metal due to fast heating — a better formed product.

Important Data On This Modern End-Heating Method Is Given In Bulletin No. 350-A. Write for it!

GAS APPLIANCE SERVICE, INC.
Industrial Gas Engineers
1936 West Balmoral Avenue Chicago 40, Illinois
REPRESENTATIVES IN MAJOR INDUSTRIAL AREAS

CIRCLE INFORM-A-GRAM KEY NO. 1902

Flexolap.. INSTANTLY AND ACCURATELY ADJUSTABLE FOR FAST LAPPING AND POLISHING

. . . without danger of galling or seizing!

The Flexolap barrel is made with a series of longitudinal slots milled "off-center" to permit sensitively flexible expansion up to 15% — or more — under pressure of the adjusting pin. This construction enables Flexolap to save valuable time and to lap rounder, straighter holes. For accurate precision take-up, as desired, to maintain size and compensate for wear on barrel . . . simply turn adjustment screw.

Illustrated at left is Flexolap Set No. 1. Includes 6 complete laps, one of each size (3/16", 1/4", 5/16", 3/8", 7/16" and 1/2"), and one additional brass barrel of each size, all held on a sturdy, serviceable stand. Price complete $14.00

Also available in sizes 7/32", 9/32", 11/32", 13/32", 15/32", 9/16", 5/8", 11/16" and 3/4". For lapping holes smaller than 3/16", use the Midget Lap. Seventeen sizes: .032, .036, .040, .046, .054, .062, .070, .079, .090, .104, .120, .135, .155, .170, .187, .218, and .250. Trial assortment (17 laps) $2.10

Write today for Catalog

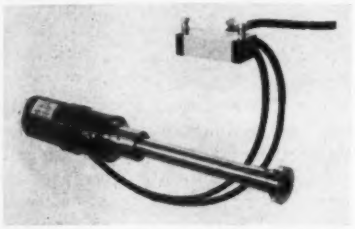
FEDERAL TOOL CORP. 3600 Pratt Blvd., Chicago 45, U.S.A.

CIRCLE INFORM-A-GRAM KEY NO. 1903

Toolmaker's Ink in a spray can saves time and work for tool, die, and model makers, production layout men, and sheet metal shops. This ink provides a perfect medium for

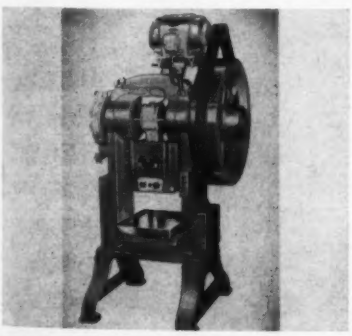
scribing crisp fine lines, it will not flake or peel, adheres to all metals, and resists heat when dry. Crown Industrial Products Co., Dept TPC, 713 Amsterdam St., Woodstock, Ill., or—**Circle Inform-A-Gram No. A62.**

An Air Actuated Collet Control is available for special purpose machines using draw-in collets or fixtures. There is no lever, no diaphragm, and no bulky cylinder.



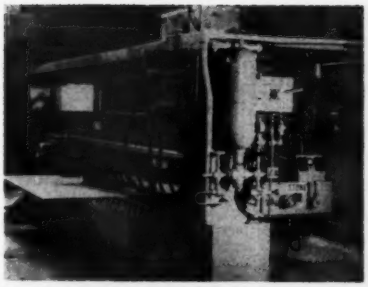
Bearing failure is negligible and the light, sturdy construction places a minimum load on the spindle. Adams Equipment, 18441 Hart St., Reseda, Calif., or —
Circle Inform-A-Gram No. A63.

A Straight Side Flywheel Press features a solid frame and capacity of 80 tons. No. 8 Model I comes in both plain and geared types and the



presses are available with air clutches. It can be used for a variety of work, such as blanking, forming, embossing, etc. Perkins Machine Co., Warren, Mass., or —
Circle Infomr-A-Gram No. A64.

A Traverse Type Cutting Machine is able to cut 1" stainless steel at approximately 3' per min. It features a stainless steel sealed roll ways and a safety guard for safety during operation. Wheel diameter is 20" x 0.150" and arbor speed is 2460 rpm with larger diameters and speeds available. The Model T-20 has a cut length of 12'. Stone Machinery Co., Inc., Manlius, N. Y., or—**Circle Inform-A-Gram No. A65.**



FEED UP TO 12"
PER PRESS STROKE!

Never before such press feeding ACCURACY... such simple compactness!

A "standard" off-the-shelf Rol-Di-Feed so versatile, so economical, it will save hundreds of dollars—do the most rugged press feeding jobs without wonder, worry or waste!

Compact—YES! . . . feeds front to back, back to front, right to left, left to right—and *diagonally!*

That's Versatility plus! A new 12" feed, a new feeding principle, a new profit in *your* press feeding operations!

Dickerman

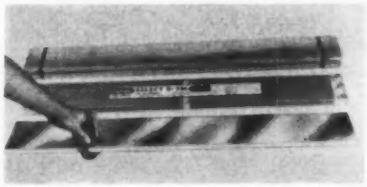
H. E. DICKERMAN MFG. CO.

340 Albany St. • Springfield, Mass.

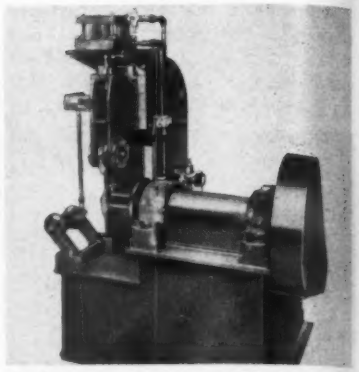
Send for literature—have a Dickerman Representative call. Would you like a demonstration on *your* material?

CIRCLE INFORM-A-GRAM KEY NO. 191

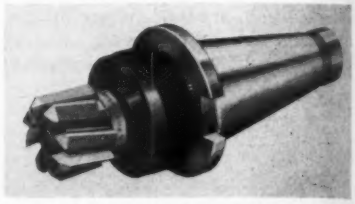
A Flat Ground Die Steel is manufactured oversize by 0.010" to 0.012" so the steel may be ground to nominal dimension after heat treatment, for the tool and die industry. Select BFM oversize ground is an air hardening steel containing 5% chromium with added sulphide particles which contribute to machining ease. The steel is available in sizes ranging from ¼" x 1" to 2" x 8" and lengths are 18 x 36". Latrobe Steel Co., Latrobe, Pa., or —
Circle Inform-A-Gram No. A66.



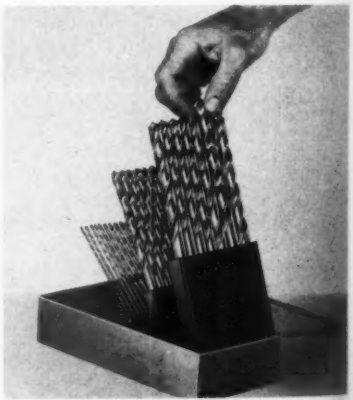
A Roto-Tube-Shear Cut-Off Machine employs two opposed, slightly offset cutting wheels for fast cutting through the wall thickness of metal tubes. The double wheel cutting action permits proceeding to subsequent fabrications without deburring. Capacity of 4½" to 8⅝" OD tubing from light wall up to ¼" wall thickness. Continental Machine Co., 1952 N. Maud Ave., Chicago 14, or —
Circle Inform-A-Gram No. A67.



A Heavy-Duty Quick-Change Holder is suited to heavy cutting in die sinking and similar operations. The holder is so designed as to be interchangeable with the regular line of universal adapters. The three-piece device is designed to provide a positive square drive, back-up screw stop, and depth adjustment. Universal Engineering Co., Frankenmuth, Mich., or —
Circle Inform-A-Gram No. A68.



Three Taper Length Drill Sets include taper length drills in fractional, wire, and letter sizes packaged in convenient folding metal index cases. All drills in these sets are made of selected high speed steel heat treated in a continuous furnace to give extra tough, uniformly hardened mill length bars. Ace Drill Corp., Adrian, Mich., or —
Circle Inform-A-Gram No. A69.



Does Your Tool Hardening Furnace Pass This SENTRY Test?

	SENTRY	YOUR FURNACE
Uniform Chamber Temperature	✓	
Truly Neutral Atmosphere	✓	
No Scale or Decarburization	✓	
Sharp Edges Maintained	✓	
Consistent Maximum Hardness	✓	
Maximum Tool Life	✓	
Quality Results — Easily Duplicated	✓	

The Sentry Furnace with the Sentry DIAMOND BLOCK METHOD of ATMOSPHERIC CONTROL brings new economy and efficiency in hardening all types of high speed and high carbon high chrome steels.

If you're getting less than SENTRY quality and performance — you're burning up profits, too! Check SENTRY against *your* furnace, *point for point.*

For final proof consult Sentry for a demonstration hardening of your high speed steel tools at no obligation.

Sentry ELECTRIC FURNACES
TRADEMARK

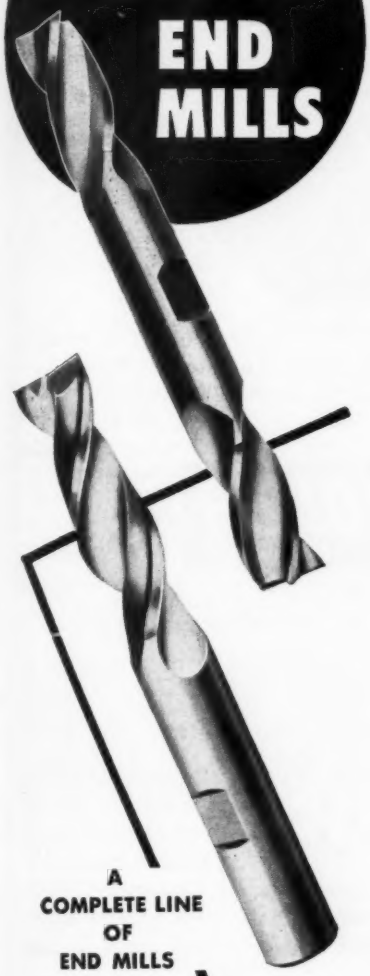
Request Catalog D-43· *Write* THE SENTRY CO., FOXBORO, MASS.

4636

CIRCLE INFORM-A-GRAM KEY NO. 192

ESTABLISHED 1916

ARROW END MILLS



A COMPLETE LINE OF END MILLS

Since 1916 Arrow has been a major supplier of End Mills — one of the oldest because Arrow has always been one of the best.

The Arrow line consists of all type of End Mills plus H. S. Steel and Carbide Tipped Specials.

ARROW TOOL & REAMER CO.
711 Stephenson Highway
P. O. Box 338 • Troy, Michigan

CALL YOUR ARROW DISTRIBUTOR

CIRCLE INFORM-A-GRAM KEY NO. 1931

KEYWAYS
—ACCURATE and UNIFORM with
The GLENNY
Adjustable Expansion
PUSH BROACH
because . . .

this sturdy simple tool can be used on any type arbor press for continuous efficient keyways — in any quantity

COSTS OFTEN REDUCED AS MUCH AS 10 TIMES

SEND FOR BULLETIN

DEALERS ALSO WRITE

DEPT. TP-12

THE EAST SHORE MACHINE PROD. CO.
70 EAST 201ST STREET
CLEVELAND 23, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1932

THE HELIOS
50 EK VERNIER
CALIPER

With Automatic Thumb Lock . . . With all Inch Scales or one Inch and one Metric Scale:
$9.90

The 55 A with set screw lock with one inch and one Metric scale or all Inch scales:
$8.90

All prices F.O.B. New York

Also available . . .
Dull Chrome finish calipers and Dial Indicator calipers.

For details on other imported precision instruments, write

6" SCALE HARDENED
Guaranteed Accuracy within .001"
Double Length Vernier

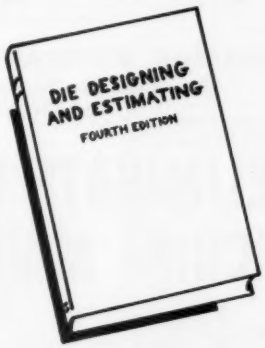
NEISE MODERN TOOLS
KARL A. NEISE, Dept. TP
404 Fourth Avenue
New York 16, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1933

DIE DESIGNING AND ESTIMATING

Fourth Edition

368 pages, 26 chapters, over 400 illustrations, charts, and graphs. 165 Practical Points in Die Design and Construction. Comprehensively indexed.



Written expressly for Die Designers, Die Engineers, Tool and Die Makers, Owners and Managers of Tool and Die Shops and Depts., Students, Apprentices and valuable, too, as a reference and refresher for the die experts who are more than qualified to write a comparable text.

$7.50* per copy

Huebner Publications, Inc., P.O. BOX 3505, 1975 LEE RD., CLEVE. 18, O.
Gentlemen:
Please ship immediately_____copy (copies) of DIE DESIGNING AND ESTIMATING, Fourth Edition, at $7.50* per copy.
Open account shipments on purchase orders of rated companies.
Otherwise, check must accompany order. No C.O.D.'s, please.
*Ohio customers add 3% sales tax.

COMPANY_____
BY_____ TITLE_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

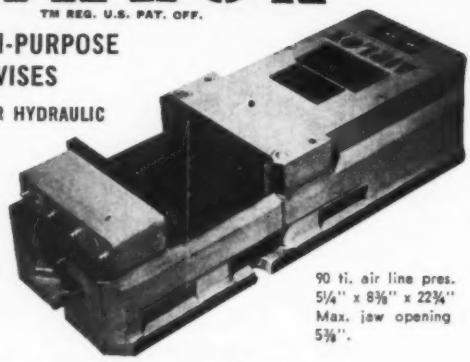
FOR PRECISION PRODUCTION

AIRLOX

TM REG. U.S. PAT. OFF.

MULTI-PURPOSE VISES

AIR OR HYDRAULIC



Type S-7 Illustrated

90 ti. air line pres. 5¼" x 8⅜" x 22¾" Max. jaw opening 5⅜".

ADAPTABLE AS POWER JIG OR FIXTURE OR SHORT STROKE BENCH PRESS

AIRLOX vises are precision built tools powered by specially engineered air or hydraulic cylinders. They can be operated manually or synchronized with the movement of a milling machine table or drill press spindle. They can be furnished in sets if desired so that the same tolerance is held between the base cross keyway and fixed jaw casting face on each vise.

AIRLOX patented wedge-&-lever action utilizes total cylinder drive, providing positive rigid grip on the work, exceptionally suited to carbide milling and almost all other milling operations.

Write for descriptive literature

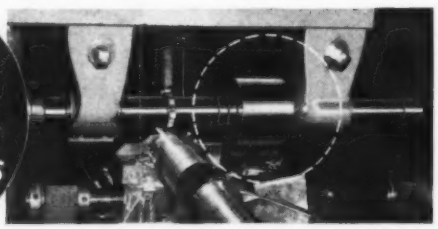
production devices incorporated

Whitehall, N. Y. - - phone 40

CIRCLE INFORM-A-GRAM KEY NO. 1941

ELIMINATE MILLING MACHINE MAINTENANCE

OF ARBOR OUTER SUPPORT BUSHINGS



OFTEN UPS SPEEDS AND FEEDS 200%

Sound too good to be true? Then see how General Electric, Jeffrey Mfg., hundreds of others **absolutely end** arbor bushing maintenance problems and decrease production costs on horizontal milling machines by replacing the bronze outer support bushing with a Jergens "Live" Sealed Roller Bearing Unit as illustrated above. Jergens Units with adjustable roller bearings **hold** precision—permit increases in milling speeds and feeds to take full advantage of carbide cutters. The rigidity of these units increase cutter life and eliminate chatter, frozen bushings, and twisted arbors.

SEE HOW HUNDREDS SAVE THOUSANDS!

WRITE FOR **FREE** CASE HISTORIES OF ACTUAL company performance reports of jobs and dollars saved!

DONLEY PRODUCTS, INC.

Dept. TP-12, 11106 Aven Ave. • Cleveland 5, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 1942

grind **TWO** parallel surfaces in **ONE** operation . . . accurately

Gardner 2H30 Precision Double Spindle Grinder

greater stability of new 2H30 grinds to closer tolerances

Get complete data in Catalog 2H30-55

GARDNER precision disc grinders

GARDNER MACHINE COMPANY 462 Gardner St. Beloit, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 1943

Don't overlook these ways to cut production costs!

OK OK SLITTER KNIVES • SHEAR BLADES • BRONZE WAYS • WORK-REST BLADES • CUT-OFF BLADES • SCRAP CHOPPERS • HARDENED SPACERS • BALL RACES • HARDENED WAYS • WEAR STRIPS • GIBS

THE OHIO KNIFE CO.

CINCINNATI 23, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 1944

Precision Keyless Drill Chuck

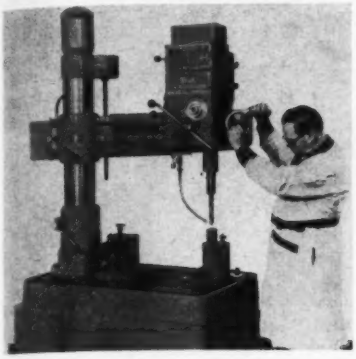
The new R. B. Tool Chucks are specially designed to have highest accuracy of concentricity. Available from stock with ¼, ⅜, ½ and ⅝ inch capacity, with any size MORSE tapered or straight shanks. Write for catalog or two weeks free tryout at our risk.

R. B. TOOL COMPANY

785 North Broadway • White Plains, New York

CIRCLE INFORM-A-GRAM KEY NO. 1945

A Radial Drill with added features speeds fixture drilling. It has a widened dovetail arm way which triples the bearing surface for long lasting accuracy and a single lever

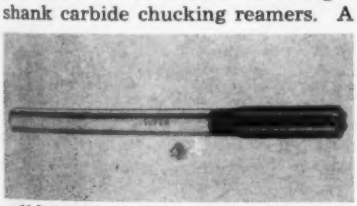


arm clamp locks the arm to column securely and quickly. 16 spindle speeds are now provided in more uniform steps. Veet Industries, 25753 Groesbeck Hwy., E. Detroit, or—**Circle Inform-A-Gram No. A70.**

An Automated Deburring Machine is keyed to the needs of the higher speeds and greater stresses of the deburring and surface finishing of extremely long or large bulky parts.

The Speed-D-Burrmatic is capable of finishing parts up to 10½′ in length in groups of four or six pieces, depending upon configuration. Speed-D-Burr Corp., 3613 San Fernando Rd., Glendale 4, Calif., or — **Circle Inform-A-Gram No. A71.**

Rigidity with reduced chatter, longer productive life between grinds, and less chance of breakage are features of a line of straight shank carbide chucking reamers. A



solid carbide flute section has replaced the usual carbide tipped flutes. Decimal sizes range from 0.230″ to 0.760″, and fractional sizes from ¼″ to ¾″. Super Tool Co., 21650 Hoover Rd., Detroit 13, or — **Circle Inform-A-Gram No. A72.**

A Precision Limit Switch which can be replaced on the job in a few seconds with no required adjustments, is the Plug-In Limit. The model 201LS1 consists of two parts; a terminal block enclosure, containing wiring connections, and a switch enclosure, including all moving mechanical and electrical parts. Micro Switch, Div'n of Minneapolis-Honeywell Regulator Co., Freeport, Ill., or —
Circle Inform-A-Gram No. A73.

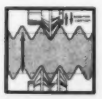
It's so easy and costs so little to SEE how you're doing

You know quickly how closely you are working to dimensional specifications when you use Federal Dial Indicating Gages. You see ahead of time whether you are taking off too much metal *before* you produce any scrap. You can see on the Dial Indicator just when you have obtained the correct dimension. Federal offers a big selection of gages from which you can choose the best for your purpose. Do you have our catalog?

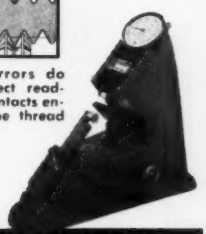
FEDERAL PRODUCTS CORPORATION
72312 Eddy Street · Providence 1, R. I.

DEPTH GAGES

Bench Type Indicating Depth Gage Model 75B-1
Long. 2″ range.



Lead errors do not affect readings. Contacts engage one thread only.



THREAD GAGES
Pitch Diameter Gage Series 45
For fast inspection of pitch diameter of threads by roller contacts. Thread lead gage is also available.

COMPARATORS
Over ten types.
Universal Dial Comparator Model 100B-20

Highly accurate. Attachments greatly extend versatility.

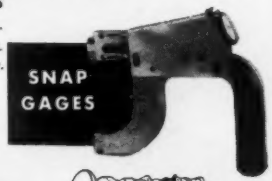
INDICATING MICROMETER

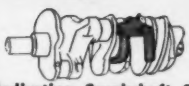
Federal Mikemaster Model 200P-1 always measures with same gaging pressure — provides uniform, accurate dial readings. Used as a Micrometer, or an Indicating Snap Gage.

GEAR GAGES

Pitch Diameter Gear Gages Series 202
Measures pitch diameter of spur gears, helical gears, splines, and chain sprockets — with either even or odd numbered teeth.

SNAP GAGES





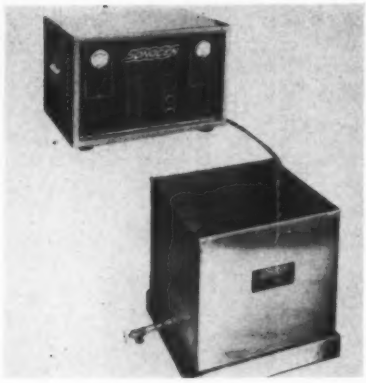
Indicating Crankshaft Gage Model 1340P-40
Extremely thin, measures diameter of crankshafts where projections are large and/or closely spaced.

CATALOG 55G
Shows most complete line of dial indicator gages. Send for copy.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

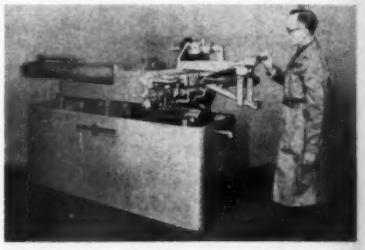


An Ultrasonic Cleaning Generator for pilot-plant or production application has been announced by Branson Ultrasonic Corp., 40 Brown House Rd., Stamford, Conn. Designed to simplify manual or conveyorized cleaning and degreasing, Model AP-200 Sonogen will usually remove insoluble soils and contaminants. **Circle Inform-A-Gram No. A74.**

A Die Handling Table lifts up to 2,500 lbs, and transports and slides them to another surface without manual strain or risk of damage. The

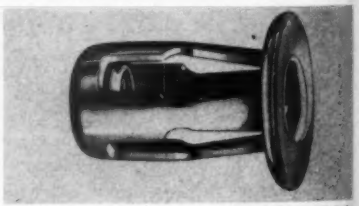
Big Beulah table is suited to the work of transporting dies from storage to press. Reinforced top-plate is 22" x 34". The Hamilton Tool Co., 832 S. Ninth St., Hamilton, O., or — **Circle Inform-A-Gram No. A75.**

An Air-Powered Broaching Fixture features fully-automatic loading provided by a magazine feed having three separate air-operated cylinders. Broach advance and return is controlled by a 6" dia, 25" stroke air-



hydraulic cylinder mounted on the end of the fixture. This model broaches ½" wide flats at a production rate of 720 pcs/hr. National Broach & Machine Co., 5600 St. Jean, Detroit 13, Mich., or — **Circle Inform-A-Gram No. A76.**

A Blind Fastener which cuts costs, speeds assembly, and solves fastening problems has been made available by Molly Corp., Reading, Pa.



The Jack Nut has threads which grip any kind of material from 0" to ⅜" thick and is self-adjusting to grip evenly on rough and curved as well as smooth and level surfaces. **Circle Inform-A-Gram No. A77.**

NOW...A CUT-OFF TOOL for EVERY Application . . .

The complete line of P.D.Q. (Portage Double Quick) Manchester cut-off tools includes tooling for all makes of Turret Lathes, Engine Lathes, Production Lathes, Automatics and Cutting-Off Machines.

This wide selection of carbide tools, designed specifically for each type of machine, offers real speed and economy in parting and grooving problems. Write for the illustrated catalog covering all the available standard types. Specials available on request.

PDQ

PORTAGE Double-Quick, Inc.

1046 SWEITZER AVENUE • AKRON 11, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 196

Now Available...
FOR YOUR CONVENIENCE

Miccro *Supreme Spray*

LAY-OUT DYE
(Purple)

A new, easy-to-use, dependable, spray Lay-Out Dye for tool, die, pattern, or template layout on metal. Dries instantly—shows up in sharp relief.

Also Still Available...

Miccro *Supreme*

LAY-OUT AND IDENTIFICATION DYE (7 Colors)

For layout on metal and quick identification of bar stock, sheets, strips, or parts. Also dries instantly and shows up in sharp relief. Available in brush-in-cap cans and larger containers.

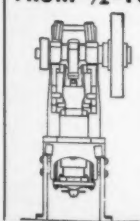
Write for circular on company letterhead.

MICHIGAN CHROME & CHEMICAL COMPANY
8615 Grinnell Ave. • Detroit 13, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 1971

DIE CUSHIONS

FOR ANY PUNCH PRESS FROM ½-TON TO 500 TONS



We invite your inquiries, as we have a complete engineering staff to analyze any of your requirements.

DAYTON ROGERS *Manufacturing Company*
MINNEAPOLIS 7B, MINNESOTA

CIRCLE INFORM-A-GRAM KEY NO. 1972

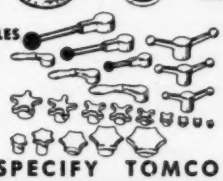
Tomco INC.

HAND WHEELS

Straight Type Offset Type

SPECIALS

- HAND KNOBS
- MACHINE HANDLES
- HANDLES
- BALL HANDLES
- LEVERS
- SPECIALTIES



GRADUATED DIALS

SPECIFY TOMCO FOR DEPENDABILITY

A Complete line of high grade hand knobs, levers, handles, hand wheels, graduated dials is available for immediate shipment from stock of standard items. Specialty items made to your specifications.

WRITE FOR INFORMATION

Tomco INC.
1623 DOUGLAS AVE., RACINE 2, WIS.

CIRCLE INFORM-A-GRAM KEY NO. 1973

YEAR END SUPPLIES

NOW!

Check Model 2D-4 for engraving panels to 30" wide. Range: 1:1 to infinity.

JIM COLEMAN
M. C. BOLTEN
E. B. Lewis
JOHN TRAVERS
A. B. KUYSER

Check Copy Type — More than 50 distinct copy styles. Sizes from ¼" to 6" high. Sunk reading right or reversed.

Check Cutter Grinder for sharpening your engraving cutters.

Check your cutter Supplies. High Speed Steel, Tungsten Carbide, Diamond Cutters.

A Full Line of Panto Engraving and Marking Machines

- Rotary Tables
- Copy Type Holders
- Work Holding Fixtures
- Endless Belts

TRADE MARK **PANTO**

Write for complete details and prices. For immediate attention write directly to manufacturer below. Ask for nearest representative.

H. P. PREIS ENGRAVING MACHINE CO.
647 U. S. Route 22, Hillside, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1974

B-R-E-A-K...
Hand Finishing Bottlenecks

WITH

PORTABLE • ELECTRIC RECIPROCATING TOOLS

These handy tools will cut out many tedious hand filling and finishing operations — Increase Production — Produce Uniform Work.

Light in weight — Delivers ⅛" or ⅜" fixed stroke at 1000 strokes per minute — Operates on 110 volts AC or DC.

ACME TOOL COMPANY

75 WEST BROADWAY NEW YORK 7, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 1975

CAMS

To Your Specifications

• • • • •

— Except Screw Machine Cams —

• • • • •

Design Assistance Offered

KIDDE PRECISION TOOL CORPORATION
10 Locust Ave., Roseland, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 1976

LIFTING DEVICES

for FAST • SAFE • BETTER Material Handling of • SHEETS • COILS • BOXES • MOLDS • DRUMS • PALLETS • 400 MODELS

H. L. BUSHMAN CO. 100 West Central Ave. Roselle, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 1977

CUMULATIVE EDITORIAL INDEX FOR 1957 ISSUES

Abrasive machining
Belt grinding of motor rotors, Jan. p. 151 (½ p)
New techniques in machining methods, Jan. p. 63 (6 pp)

Adhesives
Epoxy bonding of carbides to steel, Feb. p. 79 (5 pp)

Airfoil, machine for milling, Apr. p. 92 (1½ pp)

Air power
Air-actuated clamping blocks, Apr. p. 85 (1 p)
Air gages for measuring distance between hole centers, Sept. p. 95 (9 pp)
Circuits, safe pneumatic, self teaching methods for, July, p. 80 (4 pp)
Cylinders, 10 widely held misconceptions of, Apr. p. 132 (2/3 p)
Multiple gun drilling, air feed, May, p. 105 (3 pp)
Notebook: Tips on air equipment maintenance, Feb. p. 111 (4 pp)
Vacuum locating device for precision drilling, Sept. p. 108 (½ p)

Alloys, brazing, selection of, Aug. p. 93 (5 pp)

Apprenticeship
Dividing skilled groups, Apr. p. 114 (½ p)
Program building, Jan. p. 11 (3 pp)

Assembly
Adapters, torque wrench, for hard to reach spots, July, p. 110 (2/3 p)
Automatic, machines for, Apr. p. 89 (3 pp)
Automatic machine for, Nov. p. 93 (6 pp)
Automatic, product designing for, July, p. 16 (2-1/3 pp)
Small parts, automation for, Aug. p. 71 (1 p)

Automatic handling
Basketing workpieces, Feb. p. 119 (½ p)
Demand-feed distribution system, Jan. p. 77 (1/3 p)
Heat treating, loading gears for, July, p. 133 (1/3 p)
Product designing for, July, p. 16 (2-1/3 pp)
Shuttle transfer conveyor, Jan. p. 108 (¼ p)
Stacker for tube and bar transfer, July, p. 120 (1/3 p)
Storage unit, rotary, Apr. p. 84 (½ p)
Transfer presses, on, June, p. 87 (13½ pp)

Automation
Automated control of gear quality, May, p. 91 (6 pp)
Built-in quality control, May, p. 104 (1 p)
Capital cost of, June, p. 82 (1 p)
Color coding to simplify machine changeover, June, p. 75 (2¾ pp)
Dressing grinding wheels for, July, p. 85 (2 pp)
Example of, Oct. p. 87 (2 pp)
In-process Q-C for transfer lines, May, p. 81 (5 pp)
Magnetic memory system for, Mar. p. 219 (1/3 p)
Maintenance problems of, June, p. 82 (1 p)
Myths and fallacies of, Mar. p. 95 (4 pp)
Product designing for, July, p. 16 (2-1/3 pp)
Small parts assembly, using, Aug. p. 71 (1 p)
Standard units for, June, p. 122 (½ p)
Standard units for, Nov. p. 85 (6½ pp)
Transfer presses for, June, p. 87 (13½ pp)

Ball-broaching, for bushing assembly, Oct. p. 116 (½ p)

Ballizing, hole sizing and finishing process, Oct. p. 116 (1/3 p)

Bearings, roller, automation for, Oct. p. 87 (2 pp)

Bearingizing, internal and external sizing process, Oct. p. 114 (½ p)

Bonuses for supervisors, Feb. p. 148 (1 p)

Boring heads, multi-diameter, Feb. p. 89 (6 pp); Mar. p. 99 (6 pp)

Boring machine, multiple spindle, June, p. 104 (1 p)

Boring tool trouble analysis, Mar. p. 99 (6 pp)

Brake forming, theory of, Oct. p. 77, (8 pp)

Brazing
Air clamps for, Apr. p. 85 (1 p)
Alloy selection and joint design, Aug. p. 93 (5 pp)
Fundamentals for, May, p. 99 (5 pp)
Heating source and procedures for, Sept. p. 85 (5½ pp)
Induction, ceramic jigs for, June, p. 78 (1 p)

Broaching, external, on automatic screw machine, June, p. 73 (2 pp)

Broaching machine, automated, Jan. p. 154 (½ p)

Burnishing, Oct. p. 112 (½ p)

Burnishing, roller, internal finishing, process, Oct. p. 114 (½ p)

Cams engineered for their production in limited quantities, July, p. 92 (3 pp)

Carbide
Bonding with epoxy, Feb. p. 79 (5 pp)
Boring of multi-diameters, Feb. p. 89 (6 pp); Mar. p. 99 (6 pp)
Brazing, special fluxes for, Mar. p. 104 (¼ p)
Dies, hot heading titanium bolts with, Mar. p. 111 (1/3 p)
Dies produce quality parts, Feb. p. 58 (1 p)
Drilling and reaming of precision holes, July, p. 71 (4 pp)
Grades classified, Feb. p. 95 (4 pp)
Gun drilling, fixturing for, Mar. p. 79 (4 pp)
Machining hi-temp alloys with, Feb. p. 73 (6 pp)
Metallurgy, Feb. p. 95 (4 pp)
Milling with, Feb. p. 85 (4 pp)
Multiple gun drilling, May, p. 105 (3 pp)
Super-hard for long tool life, Aug. p. 77 (4 pp)
Tipped soldering jigs, May, p. 148 (½ p)
Tooling for automatic milling, Nov. p. 85 (6½ pp)

Chemical milling, applications of, Aug. p. 98 (2-1/3 pp)

Ceramic tooling, discussion of, June, p. 100 (1½ pp)

Circuits, safe pneumatic, self teaching methods for, July, p. 80 (4 pp)

Coated abrasive machining methods, Jan. p. 63 (6 pp)

Cold Forming
Ball-broaching for bushing assembly, Oct. p. 116 (½ p)
Ballizing, hole sizing and finishing process, Oct. p. 116 (1/3 p)
Blanks, steel, multi-diameter, Oct. p. 150 (½ p)
Bearingizing, internal and external sizing process, Oct. p. 114 (½ p)
Burnishing, process for, Oct. p. 112 (½ p)
Burnishing, roller, internal finishing process, Oct. p. 114 (½ p)
Cold extrusion, Oct. p. 95 (2-1/5 pp)
Drawing, deep, Oct. p. 105 (2 pp)
Forging, cold, Oct. p. 101 (1¾ pp)
Form and spline rolling, Oct. p. 122 (1/3 p)
Heading, cold, Oct. p. 102 (2-¾ pp)
Impact extrusion, Oct. p. 97 (3-½ pp)
Metallurgy of, Oct. p. 93 (2-1/3 pp)
Roll-forming, shaping coiled strip, Oct. p. 120 (1/3 p)
Roll-planishing, flattening weld beads, Oct. p. 120 (1/3 p)
Rolled extrusion, Oct. p. 118 (½ p)
Shot-peening, Oct. p. 122 (1/3 p)
Special report on, Oct. p. 91 (27 pp)
Spinning, Oct. p. 118 (½ p)
Stretch-wrap forming, Oct. p. 122 (1/3 p)
Swaging, Oct. p. 107 (1-3/5 pp)
Thread rolling, Oct. 109 (3-½ pp)
Tube bending, Oct. p. 120 (1/3 p)
Turks head, rod shaping multi-roll for, Oct. p. 116 (1/3 p)

Cold forming process, Fellows-Appel, Mar. p. 78 (1 p)

Color coding to simplify machine changeover, June, p. 75 (2¾ pp)

Controls
Automatic cycling for, Nov. p. 85 (6½ pp)
Automation magnetic memory system, Mar. p. 219 (1/3 p)
Electro-hydraulic servo system, Jan. p. 104 (½ p)
Electro-hydraulic transducer, Feb. p. 105 (5½ pp)
Numerical, for jig borers, etc. Apr. p. 80 (1 p)
Numerical, in aircraft industry, Feb. p. 48 (1½ pp)
Press "non-repeating" system, June, p. 108 (1/3 p)
Tape, for positioning table, Mar. p. 88 (1 p)
Tracer, for profile milling, Apr. p. 181 (¾ p)
Welding, Feb. p. 110 (¾ p)

Coolants
Abrasive machining, Jan. p. 67 (½ p)
Application on automated line, Nov. p. 85 (6½ pp)
Gun drilling, for, Mar. p. 79 (4 pp); May, p. 105 (3 pp)
Honed bores automatically sized with, Sept. p. 104 (1 p)
Inductor bushing for drilling copper, June, p. 79 (3 pp)
Synthetic, test report on, May, p. 180 (½ p)

Countersink, self-aligning, Jan. p. 94 (1/3 p)

Coupling, flexible, compensates for shaft misalignment, July, p. 106 (1 p)

Cutting tools
Bi-carbide, construction for, Aug. p. 77 (4 pp)
Ceramic, pros and cons of, June, p. 100 (1½ pp)
Form milling cutters, design and application of, Mar. p. 89 (3½ pp)
It's time to re-evaluate, July, p. 69 (1 p)
Multi-diameter, Feb. p. 89 (6 pp); Mar. p. 99 (6 pp)

Deburring of copper tubing, Jan. p. 78 (1 p)

Deep drawing of molybdenum anodes, June, p. 106 (2 pp)

Design, of high production tools, Mar. p. 74 (4 pp)
Weldment unit, layout and erection of Oct, p. 88 (2 pp)

Designing for easier machining, automatic handling and assembly, July, p. 16 (2-1/3 pp)

Diamond pins, establishing sizes of, Aug. p. 84 (2 pp)

Diamond powder cutters for dressing grinding wheels, July, p. 85 (2 pp)

Dies
Carbide, hot heading titanium bolts with, Mar. p. 111 (1/3 p)
Carbide, produce quality parts, Feb. p. 58 (1 p)
Contour sawing of, Apr. p. 100 (1 p)
Die-casting, mould coatings for, Aug. p. 91 (2 pp)
Epoxy-faced, June, p. 103 (1 p)
Forming, control of wrinkling, Nov. p. 69 (5 pp)
Large, die-layout machine for, Aug. p. 76 (1 p)
Progressive, for limited run stamping, Aug. p. 89 (2 pp)
Progressive, 9 station cut and carry, Oct. p. 73 (4 pp)
Short run, construction of, Sept. p. 81 (4 pp)
Steel rule, Oct. p. 85 (1 p)

Die Cushions, pneumatic, Nov. p. 69 (5 pp)

Die Sinker, equipped for deep tracing, Feb. p. 105 (5½ pp)

Die sets for steel rule dies, Oct. p. 85 (1 p)

Drawing
Deep, Oct. p. 105 (2 pp)
Ironing for product improvement, Nov. p. 77 (4½ pp)
Pressure ring for, Nov. p. 69 (5 pp)
Radial draw former, Nov. p. 91 (1/3 p)

Drawing lubricant selection, July, p. 87 (5 pp)

Drilling
Copper, coolant inductor bushing for, June, p. 79 (3 pp)
Gun, fixturing for, Mar. p. 79 (4 pp)
Gun, multiple, air-powered, May, p. 105 (3 pp)
Machine, deep hole, Jan. p. 51 (¼ p)
Production drilling of precision holes, July, p. 71 (4 pp)
Vacuum locating device for precision drilling, Sept. p. 108 (½ p)
Variable workpieces, Jan. p. 69 (3 pp)
Wide range of bolt circle diameters, Apr. p. 109 (1/3 p)

Drill press fixture for lapping, Aug. p. 87 (1½ pp)

Drills, trepan-type, for precision holes, July, p. 71 (4 pp)
Twist, ground for special tooling, Nov. p. 99 (2 pp)

Economics, industrial
Car battle of 1958, Sept. p. 71 (1 p)
Editors look at '57, Jan. p. 61 (1 p)
Machine tool outlook for '57 Jan. p. 72 (5-2/3 pp)
Machine tool sales to hit billion dollars, Jan. p. 156 (½ p)
Obsolescence of machine tools, June, front cover, (2 pp)
Tool and die forecast for '57, Jan. p. 156 (3/5 p)

Electrolytic grinding of honeycomb, Apr. p. 185 (1/3 p)

Engineering, definition of, Oct. p. 54 (2-1/6 pp)

Experimental designs, Apr. p. 119 (5 pp)

Extruding
Cold, Oct. p. 95 (2-1/5 pp)
Impact, Oct. p. 97 (3½ pp)
Spray lubrication for, May, p. 149 (¼ p)

Feeds for transfer presses, June, p. 87 (13½ pp)

Fixtures (see Jigs and fixtures)

Forging, cold, Oct. p. 101 (1¾ pp)

Form and spline rolling, Oct. p. 122 (1/3 p)

Form milling cutters, design and application of, Mar. p. 89 (3½ pp)

Gages
Air-type, for automation quality control, May, p. 104 (1 p)
Maintenance of, May, p. 80 (½ p)

Gaging
Air, for measuring distance between hole centers, Sept. p. 95 (9 pp)
Air, of drill jig bushings, Apr. p. 81 (3½ pp)
Automatic, for gear dimensional accuracy, May, p. 91 (6 pp)
Electronic system for grinders, Apr. p. 174 (1/3 p)
Fixture for gaging OD of segment-shaped components, Sept. p. 91 (2½ pp)
In-process quality control equipment, May, p. 81 (5 pp)
Stampings, details of, Aug. p. 73 (3 pp)

Gears, automated control of quality production, May, p. 91 (6 pp)

Grinding and finishing
Abrasive machining methods, Jan. p. 63 (6 pp)
Belt grinding of motor rotors, Jan. p. 151 (½ p)
Cylindrical machine for large light work, Jan. p. 147 (1/3 p)
Dressing grinding wheels automatically, July, p. 85 (2 pp)
Electrolytic, of honeycomb, Apr. p. 185 (1/3 p)
Fixturing for rotary surface grinder, Apr. p. 73 (5 pp)
Grinder for heavy stock removal, June, p. 86 (1 p)
Grinding crankpins automatically, Sept. p. 90 (½ p)
Numerically controlled hole grinder, Apr. p. 80 (1 p)

Precision, of servo valve components, Apr. p. 88 (1 p)
Special tool grinding, a study of, Nov. p. 99 (2 pp)
Surface grinder for large dies, July, p. 117 (1 p)
Tool post grinders, versatility of, July, p. 84 (1 p)

Grinding, tool
Form milling cutters, Mar. p. 89 (3½ pp)

Gun drilling
Fixturing for, Mar. p. 79 (4 pp)
Multiple, air-powered, May, p. 105 (3 pp)

Heading, cold, Oct. p. 102 (2¾ pp)

Heat Treating
Automatically loading gears for, July, p. 133 (1/3 p)
Critical quenching speed, Mar. p. 74 (4 pp)
Rapid quenching with reduced distortion, Jan. p. 78 (3½ pp)
Stainless steel for honeycomb structures, Sept. p. 73 (8 pp)

Honing, bores automatically sized by, Sept. p. 104 (1 p)

Hydraulics
Cylinders, 10 widely held misconceptions of, Apr. p. 132 (2/3 p)
Power unit for automatic cycling, Nov. p. 85 (6½ pp)

Industrial science, Nov. p. 12 (2-1/6 pp)

Inspection
Distance between hole centers, measurement of, Sept. p. 95 (9 pp)
100%, on small motors, May, p. 87 (3½ pp)
Tools, of, May, p. 18 (1½ pp)

Interferometer-digital counter measuring system, Mar. p. 83 (4½ pp)

Inventory
In-process, shrinkage of, May, p. 116 (1½ pp)
Management principles, Jan. p. 83 (4 pp; 12 pp in Nov. and Dec. '56 issues)

Ironing, prerequisites for, Nov. p. 77 (4½ pp)

Jigs and fixtures
Boring and turning, work holding rules for, July, p. 75 (4 pp)
Drill jig centers variable workpieces, Jan. p. 69 (3 pp)
Drill jig, universal, Nov. p. 75 (2 pp)
Fixtures, air, for silver brazing, Apr. p. 85 (1 p)
Fixtures for band saw cutting, Sept. p. 122 (2 pp)
Fixture for drill press lapping, Aug. p. 87 (1½ pp)
Fixture for gaging OD of segment-shaped components, Sept. p. 91 (2½ pp)
Fixtures for gun drilling, Mar. p. 79 (4 pp)
Fixtures for surface grinding, Apr. p. 73 (5 pp)
Jigs, ceramic, aid to brazing, June, p. 78 (1 p)
Plastic, for short runs, Feb. p. 182 (¾ p)
Tool steels for high production, Mar. p. 74 (4 pp)

Lathe
Automatic or turret, hydraulic tracing unit for, Oct. p. 90 (1 p)
Center drive, tracing, for contouring, Aug. p. 86 (1½ pp)
Turret, tooling for valve parts, Apr. p. 86 (2 pp)
Vertical chucking, May, p. 252 (1 p)

Lubricant
Castor oil, for deep drawing molybdenum, June, p. 106 (2 pp)
Drawing, selection for, July, p. 87 (5 pp)
Fire-safe for air compressors, Sept. p. 134 (½ p)
Spray, for extruding, May, p. 149 (¼ p)

Machine tool industry
Machine tool sales to hit billion, Jan. p. 156 (½ p)
Obsolescence, June, front cover (2 pp)
Outlook for '57 by industry leaders, Jan. p. 72 (5-2/3 pp)

Machining (also see specific process)
Abrasive, belt grinding of motor rotors, Jan. p. 151 (½ p)
Abrasive, new techniques in machining methods, Jan. p. 63 (6 pp)
Automatic, sequence of, Nov. p. 93 (6 pp)
Chemical milling process for, Aug. p. 98 (2-1/3 pp)
Contouring jet discs, Aug. p. 86 (1½ pp)
Contour sawing large workpieces, Apr. p. 100 (1 p)
Cost cutting with band saw, Sept. p. 122 (2 pp)
High temperature alloys with carbides, Feb. p. 73 (6 pp)
Hydraulic valves, machining and testing of, Apr. p. 101 (4 pp)
Motor load measurement detects trouble, Sept. p. 94 (1 p)
Product designing for, July, p. 16 (2-1/3 pp)
Profile milling jet engine blades, Sept. p. 118 (2/3 p)
Profiling, numerically controlled, Feb. p. 48 (1½ pp)
Spark erosion process, May, p. 164 (½ p)
Titanium, a case history of, June, p. 83 (3 pp)
Tracing without templates, Feb. p. 105 (5½ pp)
Turning and boring, work holding rules for, July, p. 75 (4 pp)

Maintenance
Automation, problems of, June, p. 82 (1 p)
Gages, May, p. 80 (½ p)
Machine parts, protection of, Oct. p. 126 (2 pp)
Management for small plants, Apr. p. 9 (2¼ p)
Preventive, Feb. p. 120 (1-1/3 pp)

Management
Automatic machining, approach to, Nov. p. 93 (6 pp)
Bonuses for supervisors, Feb. p. 148 (1 p)
Industry-education programs, organizing for, Sept. p. 57 (2-2/3 pp)
Mathematical programming for, Apr. p. 94 (6 pp)
Overtime costs, questions and answers for, Sept. p. 112 (2 pp)
Preventive maintenance records, Feb. p. 120 (1-1/3 pp)
Quality assurance and reliability, Mar. p. 12 (2¼ pp)
Role and responsibility in safety programs, Apr. p. 110 (2/3 p)
Safety economics in stamping plants, June, p. 114 (2¼ pp)
Scheduling engineers' activities, Feb. p. 173 (½ p)
The million-dollar lathe, May, p. 77 (1 p)
Time study of punch-press operations, Feb. p. 99 (6 pp)
Training for quality control, May p. 97 (2¼ pp)

Manpower shortage, 20 ways to ease, Apr. p. 78 (2 pp)

Mathematical programming, a short cut to, Apr. p. 94 (6 pp)

Measurement methods
Distance between hole centers, measurement of, Sept. p. 95 (9 pp)
Fringecount micrometer, Mar. p. 83 (4½ pp)

Metallurgy of cold forming, Oct. p. 93 (2-1/3 pp)

Methods-time measurement, Feb. p. 99 (6 pp)

Milling
Cutters, form, design and application of, Mar. p. 89 (3½ pp)
Head, hydraulic, Feb. p. 116 (1 p)
Profile, tracer controlled, Apr. p. 181 (¾ p)
Shaping giant airfoils and complex parts, Apr. p. 92 (1½ pp)
With carbides, Feb. p. 85 (4 pp)

Molybdenum anodes, deep drawing of, June, p. 106 (2 pp)

Mould coatings, function and selection of, Aug. p. 91 (2 pp)

Obsolescence of machine tools, June, front cover (2 pp)

Optical measuring system, Mar. p. 83 (4½ pp)

Patent Suits, Mar. p. 110 (1 p)

Personnel Management
Bonuses for supervisors, Feb. p. 148 (1 p)
Departmental loan of workers, Aug. p. 81 (3 pp)
Foreman selection, Mar. p. 57 (1 p); Apr. p. 148 (1-1/3 pp); May, p. 58 (1 p)
Foreman selection, evaluation contamination in, June, p. 57 (1 p); July, p. 48 (1-1/3 pp)
Foreman selection, minimizing evaluation deficiencies for, Sept. p. 15 (1-1/3 pp)
Hiring new employees, Feb. p. 14 (1 p)
Moonlighting, Oct. p. 71 (1 p)
Performance evaluation and foreman selection, May, p. 58 (1 p)
Selection testing, Jan. p. 46 (2/3 p)
Supervisor selection, evaluation for, Aug. p. 52 (1-1/3 pp)

Pins, diamond, establishing sizes of, Aug. p. 84 (2 pp)

Plastic tooling
Epoxy-faced die, June, p. 103 (1 p)
Press, metallized armor for, Nov. p. 82 (3 pp)
Short run operations, Feb. p. 182 (¾ p)

Pneumatic (see Air Power)

Press Brakes, forming forces in, Oct. p. 77 (8 pp)

Presses
Automatic for limited run stamping, Aug. p. 89 (2 pp)
Die change pushbutton controlled, Aug. p. 107 (½ p)
Dieing machine, Oct. p. 73 (4 pp)
Function of lubricant in press drawing, July, p. 87 (5 pp)
"Non-repeating" safety system, Jan. p. 108 (1/3 p)
Pre-set dies for short run production, Aug. p. 114 (½ p)
Productivity, true measurement of, May, p. 116 (1½ pp)
Punch, time study of operations, Feb. p. 99 (6 pp)
Transfer, for automation, June, p. 87 (13½ pp)

Pressure ring, application of, Nov. p. 69 (5 pp)

Preventive maintenance, usable records, Feb. p. 120 (1-1/3 pp)

Production and inventory control society formed (APICS), Apr. p. 113 (1/3 p)

Production data automatically recorded, Mar. p. 93 (1¾ pp)

Profile sharpening of milling cutters, Mar. p. 89 (3½ pp)

Quality Control
Assurance and reliability, Mar. p. 12 (2¼ pp)
Automated gear production with, May, p. 91 (6 pp)
Built into automation lines, May, p. 104 (1 p)
Control of surface quality and geometry, May, p. 108 (4 pp)
Peg-board Q-C, May, p. 78 (2½ pp)
Prove it, May, p. 114 (½ p)
Reliability, evolution of, Mar. p. 73 (1 p)
Semi and final assembling small motors by, May, p. 87 (3½ pp)
Tool proofing, a means of, May, p. 18 (1½ p)
Training for, May, p. 97 (2¼ pp)
Transfer-type special machine tools with, May, p. 81 (5 pp)
TV system assists spotwelding control, Sept. p. 120 (½ p)
Zero center method of, May, p. 78 (2½ pp)

Quenching with reduced distortion, Jan. p. 78 (3½ pp)

Reamers, trepan-type, for precision holes, July, p. 71 (4 pp)

Recorder, automatic, of production data, Mar. p. 93 (1¾ pp)

Rolled extrusion, Oct. p. 118 (½ p)

Roll-forming, shaping coiled strip, Oct. p. 120 (1/3 p)

Roll-planishing, flattening weld beads, Oct. p. 120 (1/3 p)

Safety
Does not cost money: it pays money, June, p. 114 (2¼ pp)
Holding employee interest in, Jan. p. 140 (1¼ pp)
Investigating and reporting of industrial accidents, June, p. 102 (2/3 p)
Job safety, analysis of, Aug. p. 100 (2/3 p)
Programs, management's role and responsibility in, Apr. p. 110 2/3 p)
Safer plants, a plan for, Oct. p. 124 (2/3 p)

Saws, band, heavy duty, Nov. p. 92 (1 p)

Scrap disposal, automatic, Jan. p. 149 (½ p)

Screw-machine
Automatic, external broaching on, June, p. 73 (2 pp)
High speed, holds limits to 0.0005", Apr. p. 93 (1 p)
Plunge thread rolling on, May, p. 86 (1 p)

Shot peening, Oct. p. 122 (1/3 p)

Small business, essentially of, Nov. p. 67 (1 p)

Small plants, maintenance management of, Apr. p. 9 (2¼ pp)

Soldering, automatically, of fuel-tank filler necks, Aug. p. 106 (1½ p)

Special machines (also see "Automation")
Automatic, for soldering, Aug. p. 106 (1½ pp)
Automatic, from standard units, Apr. p. 89 (3 pp)
Profile milling jet engine blades, Sept. p. 118 (2/3 p)

Spinning, Oct. p. 118 (½ p)

Stampings
Gaging of, Aug. p. 73 (3 pp)
Limited run, press and die for, Aug. p. 89 (2 pp)

Standard units for
Automatic machines, June, p. 122 (½ p)
Automatic production, Nov. p. 85 (6½ pp)
Automatic special machines, Apr. p. 89 (3 pp)
Versatile boring machine, June, p. 104 (1 p)

Steel
Stainless, for honeycomb structures, Sept. p. 73 (8 pp)
Standards, guide to specifying, Feb. p. 126 (1-2/3 pp)
Tool, proper selection of, Mar. p. 74 (4 pp)

Stretch-wrap forming, Oct. p. 122 (1/3 p)

Surface quality and geometry, laboratory control of, May, p. 108 (4 pp)

Swaging, Oct. p. 107 (1-3/5 pp)

Tape, for positioning table, Mar. p. 88 (1 p)

Thread rolling, Oct. p. 109 (3½ pp)

Titanium, production machining of, June, p. 83 (3 pp)

Tool design and fabrication, Mar. p. 74 (4 pp)

Tools
Inspection of, May, p. 18 (1½ pp)
Press, metallized armored plastic, Nov. p. 82 (3 pp)

Training, for quality control, May, p. 97 (2¼ pp)

Transfer machine
Automatic, loading and unloading, Nov. p. 85 (6½ pp)
Handling 36 different parts, June p. 75 (2¾ pp)

Transfer presses for automation, June, p. 87 (13½ pp)

Tube bending, Oct. p. 120 (1/3 p)

Tubing, deburring of copper, Jan. p. 78 (1 p)

Turks head, multi-roll rod shaper, Oct. p. 116 (1/3 p)

TV for die-layout machine, Aug. p. 76 (1 p)

Welding
Automatic arc, Jan. p. 82 (½ p)
Controls, Feb. p. 110 (¾ p)
Equipment for large assemblies, Nov. p. 74 (1 p)
Layout and erection unit for, Oct. p. 88 (2 pp)
Machine automated for welding, assembling, machining, testing, July, p. 128 (1/3 p)
Spatter problem solved, Feb. p. 118 (1 p)
Spot, TV system assists control of Sept. p. 120 (½ p)

Wheel dressing process, grinding, July, p. 85 (2 pp)

Work holding rules for turning and boring, July, p. 75 (4 pp)

ADVERTISERS' INDEX

A.I.T. Diamond Tool Co. 169
Accurate Bushings Co. 154
Ace Drill Bushing Co., Inc. 162
Ace Drill Corp. 168
Acme Industrial Co. 125
Acme Tool Co. 197
Aget Mfg. Co. 183
Alina Corp. 179
Allegheny Ludlum Steel Corp. 171
Allied Products Corp., Richard Brothers Punch Div. 34
Alpha Press & Machine, Inc. 186
American Chain & Cable Co. Wilson Mechanical Instrument Div'n. ..148
American Machine & Foundry Co. 169
American Positive Grip Vise Corp. 172
American Pullmax Co., Inc. 58
Ames Co., B. C. 12
Anocut Engrg. Co. 190
Applied Mechanics Corp. 144
Armstrong Bros. Tool Co. 174
Arrow Tools, Inc. 180
Arrow Tool & Reamer Co. 193
Atlas Press Co., Clausing Div. 118, 119

Balas Collet Mfg. Co. 7
Barber-Colman Co. 126
Barber-Colman Co., Hendey Machine Div. 128
Bausch & Lomb Optical Co. 64, 66
Bay State Abrasive Products Co. 203
Bearings, Inc. 16
Bellows Co., The 57
Blanchard Machine Co., The 26
Bliss Co., E. W. 55, 117
Branch Mfg. Co. 183
Britain-Gridley Machine Div., New Britain Machine Co. 39
Brown & Sharpe Mfg. Co. 68
Bryant Chucking Grinder Co. 150
Buck Tool Co. 187
Buckeye Tools Corp. 108
Bushman Co., H. L. 197

Central Safety Equipment Co. 189
Challenge Machinery Co., The 61
Chandler Tool Co. 161
Chicago Tool & Engrg. Co. 176
Cincinnati Milling Machine Co., The ...105
Clark Co., Robert H. 184
Clausing Div., Atlas Press Co. 118, 119
Clearing Machine Corp., Div. of U. S. Industries, Inc. 14
Cleveland Crane & Engrg. Co., The 6
Colonial Broach & Machine Co. 137
Comtor Co. 124
Continental Tool Works, Div. Ex-Cell-O Corp. 142
Cook, Inc., Lawrence H. 160
Cooper Weymouth, Inc. 189
Covel Mfg. Co. 63
Crucible Steel Co. of America 27, 38
Cullen Mfg. Co. 130

Dalzen Mfg. Co. 135
Darwin & Milner, Inc. 46
Dayton Rogers Mfg. Co. 189, 197
Dearborn Gage Co. 41
Defiance Machine & Tool Co. 176
Detroit Die Set Corp. 29
Detroit Reamer & Tool Co. 121
Detroit Testing Machine Co. 146
Detterbeck Co., The George L. 141
DeVlieg Machine Co. 107
Dickerman Mfg. Co., H. E. 191
Die Supply Div. of E. W. Bliss Co. 47
DoAll Co., The 113
Donley Products, Inc. 194
Donleys' Sons, Inc., Ernest F. 149
Drillmation Co. 158

Durable Punch & Die Co. 167
Durant Tool Supply Co. 130, 154
Dykem Co., The 172

East Shore Machine Prod. Co. 193
Economy Engineering Co. 189
Edlund Machinery Co. 59
Eisler Engineering Co., Inc. 158
Engis Equipment Co. 124
Erickson Tool Co. 70
Ex-Cell-O Corp. 159
Ex-Cell-O Corp., Continental Tool Works Div. 142

Federal Press Co., The 9
Federal Products Corp. 195
Federal Tool & Mfg. Co. 130
Federal Tool Corp. 190
Feedall, Inc. 124
Fonda Gage Co., Inc. 160

ADVERTISING REPRESENTATIVES

CHICAGO 1: Robert R. Pierson, 333 N. Michigan Ave., FRanklin 2-4811

CLEVELAND 18: Jerry J. Miller, 1975 Lee Rd., FAirmount 1-4040

DETROIT 2: R. F. Pickrell, Larry Pickrell, 318 Stephenson Bldg., TRinity 1-0790

NEW YORK: Philip N. Meade, 60 E. 42nd Street, Room 411, New York 17, N. Y., YUkon 6-7695

NEW ENGLAND: R. N. Jorgenson, P. O. Box 55, Granby, Conn. OLdfield 3-6759, OLdfield 3-6850

LOS ANGELES 32: M. D. Pugh, Donn Pugh, P. O. Box 32188, CApitol 2-8857

Gaertner Scientific Corp., The 149
Gage Co. 153
Gardner-Denver Co. 36
Gardner Machine Co. 194
Gas Appliance Service, Inc. 190
Gatco Rotary Bushing Co. 166
Gay-Lee Co. 124
Glover Mfg. Co. 179
Gorton Machine Co., George 56
Graphic Systems 149
Graymills Corp. 173
Greenfield Tap & Die Corp. 115
Greenlee Brothers & Co. 13
Grip Nut Co. 160

Hamilton Tool Co., The 28, 143, 145
Hammond Machinery Builders, Inc. 202
Hannifin Corp. 146, 179
Hardinge Brothers, Inc. 204
Heimann Mfg. Co. 157
Heinrich Tools, Inc. 185
Hendey Machine Div., Barber-Colman Co. 128
Hill Acme Co. 161
Horton Chuck Div., Greenfield Tap & Die Corp. 65
Hovis Screwlock Co. 182
Huebner Publications, Inc. 184, 193, 201, 202
Huppert Co., K. H. 184
Hutchinson Co., William T. 140
Hydraulic Press Mfg. Co. 11

Industrial Tectonics, Inc. 176

Jaco Devices, Inc. 140, 150, 179
Jergens Tool Specialty Co. 169
Jersey Mfg. Co. 144
Johnson Gas Appliance Co. 146
Jones & Lamson Machine Co. 116

Kalamazoo Tank & Silo Co. 169
Kennametal, Inc. 30
Kidde Precision Tool Corp. 114, 197

Lakeside Steel Improvement Co., The ...180
Lamina Dies & Tools, Inc. 72
Lapeer Mfg. Co. 120
Lavallee & Ide, Inc. 4
Lee Co., K. O. 111, 166
Levin & Son, Inc., Louis 153
Littell Machine Co., F. J. 48

Madison-Kipp Corp. 141
Mead Specialties Co. 157
Metal Carbides Corp. 25
Mettler Machine Tool, Inc. 123
Meyers Co., Inc., W. F. 184
Michigan Chrome & Chemical Co. 197
Micro-Plane, Inc. 157
Moline Tool Co. 18
Monroe Engrg. Products, Inc. 144
Montgomery & Co., Inc. 175
Moore Special Tool Co., Inc. 10, 175
Morse Co., H. E. 3
Motch & Merryweather Co., Inc., The 33

National Acme Co., The 45
National Tool Salvage Co. 122
Neise, Karl A. 149, 193
New Britain Machine Co., Britain-Gridley Machine Div. 39
Newcomer Products, Inc. 54
Niagara Machine & Tool Works 20
Nichols-Morris Corp. 154
Nicholson File Co. 53
Nilson Machine Co., A. H. 62

Ohio Knife Co., The 194
O'Neil-Irwin Mfg. Co. 188
Onsrud Machine Works, Inc. 156
Opto-Metric Tools, Inc. 111
Ortman-Miller Machine Co. 114

Perkins Machine Co. 177
Petz-Emery, Inc. 176
Pipe Machinery Co., The 23
Portage Double-Quick Tool Co. 196
Portage Machine Co., The 50
Porter Precision Products 151
Preis Engraving Machine, H. P. 197
Procunier Safety Chuck Co. 120
Production Devices, Inc. 194
Producto Machine Co. 17, 150
Punch Products Corp. 132
Putnam Tool Co. 19

R. B. Tool Co., Inc. 194
Reid Brothers Co., Inc. 24
Reid Tool Supply Co. 175
Rice Pump & Machine Co. 114

Richard Brothers Punch Div., Allied Products Corp. 34
Richards Co., J. A. 114
Ring Punch & Die Co. 140
Rite-O-Tool & Gage Co. 130
Rockwell Mfg. Co., Delta Power Tool Div. 133
Royal Design & Mfg., Inc. 180
Royal Oak Tool & Machine Co. 147
Royal Products 175

Scherr Co., Inc., George 114, 120
Scully-Jones & Co. 136
Sentry Co., The 192
Service Machine Co. 175
Severance Tool Industries, Inc. 153
Sheffield Corp., The 42
Shell Chemical Corp. 109
Shore Instrument & Mfg. Co., Inc. 158
Silber Products, Inc. 157
Size Control Co., Div. of American Gage & Machine Co. 49
South Bend Lathe Works 157
Spellman Co., R. L. 157
Sperry Products, Inc. 122
Spurgeon Company 183
Standard Die Set Mfgrs., Inc. 52
Standard Parts Co. 170
Standard Pressed Steel Co. 44, 69
Star Stainless Screw Co. 202
Stupakoff Div. of The Carborundum Co. 37
Sturtevant Co., P. A. 150
Superior Steel Products Corp. 22

Tannewitz Works, The 144
Techno-Products Corp. 111
Teeter, C. B. 172
Thomson Industries, Inc. 106
Threadwell Tap & Die Co. 51
Timken Roller Bearing Co., Steel & Tube Div. 8
Tomco Products Co. 197
Tomkins-Johnson Co. 181

Union Gage Corp. 130
United States Diamond Wheel Co. 160
U. S. Engineering Co. 120
U. S. Industries, Inc., Clearing Machine Corp., Div. 14
U. S. Tool Co., Inc. 112
Unitron Instrument Div'n. of United Scientific Co. 141
Universal Engineering Co. 32, 178

Vascoloy-Ramet Corp. 5
Verson Allsteel Press Co. 152
Viking Tool Co. 175
Vlier Engineering, Inc. 35
V & O Press Co., The Div., Emhart Mfg. Co. 2
Vulcan Tool Co. 166

Wachs Company, E. H. 122
Wales-Strippit Corp. 31
Walls Sales Corp. 179
Wardwell Mfg. Co., The 154
Warner & Swasey Co. 67
Watts Brothers Tool Works 114
Weldon Tool Co. 160
Wells Mfg. Corp. 183
Wheelock, Lovejoy & Co., Inc. 60
Whistler & Sons, Inc., S. B. 161
Wickman Mfg. Co. 155
Willey's Carbide Tool Co. 134
Wilson Mechanical Instrument Div'n., American Chain & Cable Co. 148
Wirth & Son, Inc., Carl 150
Woodworth, N. A. 158

Yoder Co., The 172
Yost Mfg. Co. 166

Zagar Tool, Inc. 131

TECHNICAL BOOKS

HUEBNER PUBLICATIONS, INC.

1975 LEE ROAD, CLEVELAND 18, OHIO

Gentlemen: Please send me the publications I have checked.

☐ **DIE DESIGNING AND ESTIMATING**
Fourth edition. 368 pages, 26 chapters, and over 400 illustrations, drawings, charts and graphs. Extensively revised and enlarged plus a special section of 165 Practical Points in Die Design and Construction. Completely indexed.
_____copies @ $7.50 per copy. Total $_____

☐ **MICROSTRUCTURES OF DIAMOND SURFACES**
By S. Tolansky. 11 chapters of original research in the field of diamond growth. New optical techniques explained and illustrated which enable height or depth features as small as one twenty-five millionth of an inch to be resolved and magnifications in depth of half a million times to be made. 143 special art plates.
_____copies @ $8.50 per copy. Total $_____

☐ **DIAMOND TOOLS**
By Paul Grodzinski. A 379-page handbook on the industrial use of diamonds. Case histories and illustrations describe those applications in which the diamond has proved the most satisfactory tool in performance, precision and economy.
_____copies @ $4.50 per copy. Total $_____

☐ **DIAMOND TECHNOLOGY**
By Paul Grodzinski. The only standard work on the subject and the only book of its kind in technical literature. 784 pages, 93 working tables, and over 486 photographs and drawings.
_____ copies @ $10.00 per copy. Total $_____

☐ **GEARS for Small Mechanisms**
By W. O. Davis. 20 chapters, profusely illustrated covering everything from The Theory and Practice of the Design of Very Small Gears to The Design of Tools for Cutting and Generating Gear Tooth Forms.
_____copies @ $5.00 per copy. Total $_____

☐ **TREATISE ON MILLING AND MILLING MACHINES**
By The Cincinnati Milling Machine Co. Gives you the answer to practically every metalworking problem in the field of milling from the toolroom to fixture design and high production milling. 896 pages, over 200 formulas and 700 illustrations and charts.
_____copies @ $8.00 per copy. Total $_____

☐ **THE PRINCIPLES OF INVENTORY MANAGEMENT that Lead to Higher Profits**
By Nyles V. Reinfeld. An authoritative 32-page treatise on the economic aspects of analysis within your existent inventory control system. Includes order quantity analysis, re-order point analysis, marginal analysis and safety allowances in continuous production.
_____copies @ $2.00 per copy. Total $_____

☐ **COLD FORMING OF THE STAINLESS STEELS**
By Lester F. Spencer. 28 pages of KNOW-HOW on the blanking, punching, perforating, and bending, forming, deep drawing and spinning of the stainless steels.
_____copies @ $1.00 per copy. Total $_____

☐ **MACHINING, HEAT TREATMENT & PICKLING OF THE STAINLESS STEELS**
By Lester F. Spencer. 36 pages on the working of stainless — including drilling, tapping, threading, reaming, skiving, milling, broaching and shaving, plus heating and quenching procedures.
_____copies @ $1.50 per copy. Total $_____

TOTAL AMT. OF ORDER $ ____

Check, money order or cash with order, please. Open account shipments on company purchase orders when total amount exceeds $3.00. No. C.O.D.'s please. Ohio customers add 3% sales tax. Quantity Prices quoted on request.

COMPANY_____

BY_____ TITLE_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

Star Stainless screws have clean—bright and—shiny—heads

STAR STAINLESS SCREW CO.

CORROSION RESISTANT

679 Union Blvd., Paterson 2, N. J.
Telephone: Little Falls 4-2300
Direct N. Y. Phone: WI 7-9041
Direct Phila. Phone: WA 5-3660

CIRCLE INFORM-A-GRAM KEY NO. 2021

BUY U. S.

SAVINGS BONDS

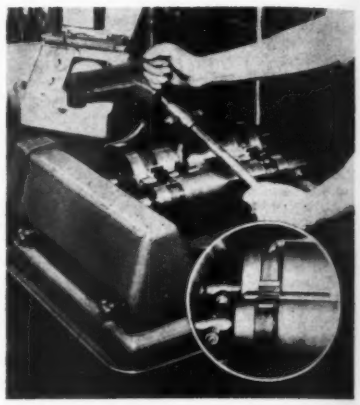
CUSTOM CONTOURED ROLLERS FACILITATE CYLINDRICAL LAPPING

Cylindrical lapping machines with custom made contour cut-outs built into the rollers, provide greater speed and accuracy for lapping cylindrical piece parts with shoulders or other angular obstructions.

This new approach to cylindrical lapping was developed by the Spitfire Tool Company, to answer the requirement for precision lapping on large quantity runs. Instead of balancing each cylindrical piece part on the lapping roller to lap journals and other cylindrical projections, contour cut-outs permit the part to be literally dropped into the correct position for lapping.

Contour cut-outs are engineered into rollers according to specifications of individual piece parts. However, rollers incorporating these cut-outs can also be used for lapping, roughing and finishing of other cylindrical piece parts.

The lapping machine's rollers are uniquely designed to permit roll change-over in minutes. Rollers and their sleeve bearings are removed as a single unit merely by loosening a set screw at either end. This arrangement also saves time and assures maximum accuracy when new rollers are replaced since no testing or gaging is necessary. Set screws are simply threaded to tightest position, and the new roller is known to be in precisely correct position for accurate operation.



BANISH DUST DESTRUCTION
BREATHE CLEANER AIR
WITH
Hammond
DUSKOLECTORS

Collect dust and dirt before it becomes destructive, and –

- Provide healthier working conditions
- Protect costly machines
- Reduce maintenance costs

Cleaner air is one of your best investments. Our DusKolectors Don't Cost – They Pay.

Clip this ad to your letterhead –
Literature and interesting installation information will be sent at once

CYCLONE

A MUST FOR DUST!

Hammond Machinery Builders INC.
1631 DOUGLAS AVE., KALAMAZOO, MICHIGAN

FILTER

Hammond OF KALAMAZOO "GOOD MACHINERY SINCE '82"

CIRCLE INFORM-A-GRAM KEY NO. 2022

New Product Available to organization wanting to diversify. Salable anywhere that locating of people without delay is a necessity. Market would include hospitals, industrial plants, offices, department stores, etc.

If interested, write Box No. D 169, TOOLING & PRODUCTION Magazine, 1975 Lee Road, Cleveland 18, Ohio.

TECHNICAL BOOKS

MICROSTRUCTURES OF DIAMOND SURFACES by Tolansky. 11 chapters of original research in the field of diamond growth. New optical techniques explained. 143 special art plates. $8.50 per copy

DIAMOND TECHNOLOGY by Paul Grodzinski. 784 pages, 93 working tables, and over 486 photographs and drawings. The only standard work on the subject. $10.00 per copy

GEARS FOR SMALL MECHANISMS by W. O. Davis. 20 chapters profusely illustrated covering theory, design and practice of cutting and generating gear tooth forms. $5.00 per copy

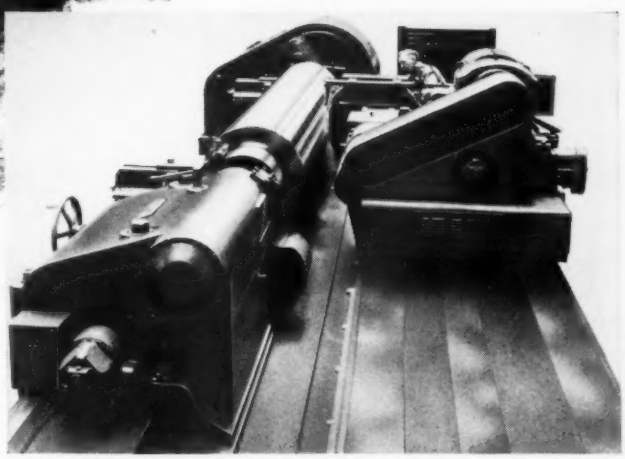
COLD FORMING OF THE STAINLESS STEELS by Lester F. Spencer. A 28-page pamphlet on the subject. $1.00 per copy

MACHINING, HEAT TREATMENT & PICKLING OF STAINLESS by Lester F. Spencer. 36 pages on the working of stainless steel. $1.50 per copy

COMPANY PURCHASE ORDERS OR CASH, PLEASE. SORRY, NO C.O.D.'S

HUEBNER PUBLICATIONS, INC.
P.O. Box 3505, Cleveland 18, Ohio

He's an expert's expert on roll-grinding!



THE MEANEST PROBLEMS are his meat in a field where it takes a microscope to spot a mistake and half a lifetime of solid, practical experience to know what to do about it.

HAROLD M. "BUN" WALKER gained that experience during 18 years with Jones & Laughlin, Allegheny Ludlum, U. S. Steel . . . 8 more with Bay State in the Pittsburgh area. His field research plus Bay State's lab research, manufacturing techniques and sales engineering have built Bay State's reputation as a major source of supply for roll-grinding wheels . . . all bonds: shellac, resinoid and vitrified.

YOUR PROBLEMS may require more than just a change of wheels. Your Bay State man, like "Bun" Walker, is an experienced specialist in finding practical, economical solutions to *all* basic grinding problems.

Better Grinding at Lower Cost—that is Our Business

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
Branch Offices and Warehouses: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh.
In Canada: Bay State Abrasive Products Co. Ltd., Brantford, Ont. *Distributors:* all principal cities.

CIRCLE INFORM-A-GRAM KEY NO. 250

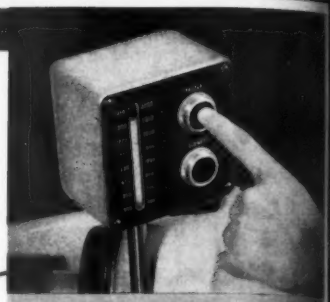
HUEBNER PUBLICATIONS, INC.
1975 Lee Rd., Cleveland 18, O.

FORM 3579 REQUESTED

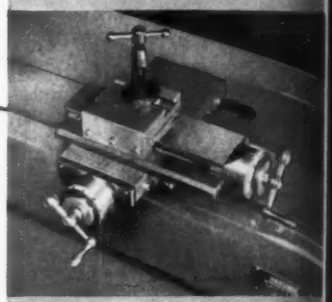
HARDINGE
ELMIRA. N.Y.

PUSH BUTTON PRECISION LATHE

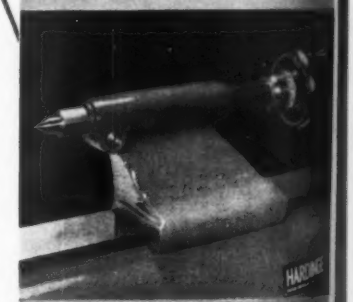
Permits Unskilled Operators to Produce Precision Parts



New Spindle Speed Control by Push Button. Spindle speeds from 230 to 3500 are instantly available with this simple push button control. Easily read speed indicator shows the exact spindle speed at all times.



New Compound Slide Rest. Speed and Accuracy of operation of this unit obsoletes all other Compound Slide Rests. Can be applied or removed in 5 seconds or less.



New Screw Feed Tailstock. Correct design and solid construction will support load easily providing accurate control and "fine feel" for precision work.

The operating simplicity of the HARDINGE Model DV59 High Speed Precision Lathe enables relatively unskilled operators to produce parts within close tolerances *without expensive tooling.*

Infinitely variable spindle speed control gives exact speed for desired finish and highest production.

Capacity — 1-1/16" round; Swing 9"; Spindle speeds — 230 to 3500 R.P.M.

2337

Write for Bulletin DV59

HARDINGE BROTHERS, INC.
ELMIRA, N. Y.